

3. AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

3.0 INTRODUCTION

The purpose of this chapter is to describe physical, biological, and social aspects of the human environment relative to the significant issues and the environmental consequences of the three alternative oil and gas leasing scenarios being considered in detail. Separate background reports have been prepared for biological and cultural resources. These unpublished reports are located in the project files at the Forest Supervisor's Office. Information regarding the affected environment and environmental consequences is presented according to the issue areas identified during public scoping (see Chapter 2).

Impacts are defined as modifications to the environment, as it presently exists, that are brought about by an outside action. Leasing may result in well drilling and development activities. A reasonably foreseeable scenario of these activities is used to help assess the potential impacts of leasing. Since a prediction is used at the leasing stage, future oil and gas activities under new leases resulting in ground-disturbing activities will require further environmental review, in accordance with NEPA, prior to implementing the activities.

Using the information regarding the potentially affected environment and a description of potential oil and gas activities as detailed in Appendices C and D, resource specialists identified the types of impacts that each alternative could have relative to the issues identified. Impacts can be beneficial (positive) or adverse (negative). Impacts can be long lasting (long-term), or temporary (short-term). In the case of this analysis, long-term impacts are defined as those that would substantially remain for the life of the project or beyond. Short-term impacts are defined as those changes to the environment during construction that would generally revert to pre-construction conditions at or within a few years of the end of construction. Impacts can vary from no change, or only slightly discernible change, to a full modification or elimination of the environmental condition.

Impacts to the environment are discussed in terms of their direct, indirect, and cumulative effects, as defined in 40 CFR 1508.7 and 1508.8:

- **Direct Effects**—Effects caused by the action and occurring at the same time and place.
- **Indirect Effects**—Effects caused by the action but occurring later in time or further removed in distance.
- **Cumulative Effects**—Effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions. Included in the cumulative effects analyses are the effects of current and future activities.

3.0.1 DIRECT EFFECTS

The direct effects of each alternative are addressed in sub-chapter sections on each issue. The projected surface disturbance and oil and gas production based on the RFD projections revised for each alternative leasing scenario are shown in Table 2.14 at the end of Chapter 2.

3.0.2 CUMULATIVE EFFECTS

Cumulative effects projections are based on the total net effect of all past, present, and reasonably foreseeable projects. The net effect of all past and present projects is expressed in terms of the affected environment, presented as the first heading in each of the sub-chapter sections for each issue.

In order to complete the cumulative effects analysis, the addition of the reasonably foreseeable projects yet to occur must be considered. The RFD has projected the reasonably foreseeable oil and gas projects. In addition to reasonably foreseeable Forest Service projects, the following agencies were contacted regarding reasonably foreseeable projects under their jurisdiction that might contribute to cumulative effects relative to the significant issues being addressed:

- Harding County, Office of the Auditor
- Bureau of Land Management, North and South Dakota
- South Dakota State Department of Environmental and Natural Resources
- South Dakota State Lands Commissioner
- South Dakota Department of Fish and Game, regional and local offices

As a result of these contacts, the following projects are projected:

- Harding County has just completed the Cave Hills road improvement project. No other projects by the County are planned within the oil and gas leasing potential project area.
- The South Dakota State Department of Environmental and Natural Resources cannot predict the amount of activity on state lands that would require permits through their office, but not many are expected.
- The South Dakota State Department of Fish and Game is planning a project to address sage grouse effects. This project will be undertaken to improve sage grouse habitat and will not adversely contribute to the Sioux Oil & Gas Leasing project effects on the sage grouse.
- The State Lands Commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.
- The Bureau of Land Management expects approximately 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.
- USFS projects on the Sioux Ranger District:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users regarding this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of a new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214. Implementation is planned for 2003
- Continued grazing leases

3.1 ISSUE 1: BIODIVERSITY

3.1.1 AFFECTED ENVIRONMENT

This issue arises from concern that proposed oil and gas exploration, development, and production might reduce natural biological diversity through habitat loss and/or disturbance and direct effects to native wildlife species of concern. This analysis focuses on projected effects of alternative leasing scenarios upon listed, sensitive, indicator, and selected “key” species (e.g. game species and raptorial birds). The measure of the effects is the projected acres of habitat disturbed based on the RFD projections.

The grassland/butte ecosystems form a variety of ecotonal conditions that provide for a diverse mix of wildlife and plant species. This part of Harding County is considered a highly unique (National Geographic Society 2002) and regionally, if not nationally, important complex of ecosystems, primarily in relation to the density of raptor nesting in the scoria/rocky outcrops found throughout the units (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, October 28, 2002). Records indicate 116 golden eagle (*Aquila chrysaetos*) nests statewide of which 67 (58%) are in Harding County; 20 merlin (*Falco columbarius*) nests statewide of which 18 (90%) are in Harding County; and 32 prairie falcon (*Falco mexicanus*) nests statewide of which 22 (69%) are in Harding County. Most of these are on National Forest System lands. These lands also harbor four big game species [mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), pronghorn (*Antilocapra Americana*) and the introduced wild turkey (*Meleagris gallopavo*)], and provide habitat for as many as 19 Forest Service and Bureau of Land Management (BLM) sensitive species.

3.1.1.1 General Description of Sioux Ranger District Terrestrial Biological Resources

The project area landform consists of buttes or mesas, rising above rolling grasslands and sparsely vegetated badlands. Many of these contain stands of ponderosa pine of varying size. Much of the area is interspersed with scoria/sandstone outcrops that, along with the adjacent grasslands that provide foraging, provide a unique situation for raptor habitation

The primary land cover in the project area is native grassland with ponderosa pine and scoria/sandstone outcrops located throughout. Considerable amounts of bare ground (badlands) with woody draws and riparian areas are found in several locations. Infrequent stands of juniper, aspen, and cottonwood forests comprise a small acreage scattered throughout these units. These latter vegetative types provide for a diversity of the habitat and are subsequently much more important than their limited acreage would infer.

Native terrestrial wildlife occupying the project area consists of species commonly found as elements of the short-grass prairie grassland, with the larger stands of coniferous-forested and riparian/hardwood areas providing for conditions suitable to some non-grassland species. None of these species is specifically unique to the area or to the existing habitats.

The Custer National Forest Land and Resource Management Plan (USFS 1987, p. 17) categorizes biotic resources into threatened and endangered, sensitive species (TES), and

management indicator species (MIS). These two groups comprise the focus species/habitat indicators necessary for analyzing effects from resource management actions.

Common large wildlife species found in the project area include pronghorn in the open grasslands, and deer, both mule (*Odocoileus hemionus*) and whitetail (*O. virginianus*), that are found where suitable cover and forage is available. There are currently no known populations of Rocky Mountain elk (*Cervus canadensis*) or Rocky Mountain bighorn sheep (*Ovis canadensis*). Raptorial birds (eagles, falcons, hawks, and owls) utilize the rimrock cliff interface of the scoria/sandstone outcrops as nesting habitat, foraging in the adjacent grassland areas. Ponderosa pine stands harbor several forest species, including providing nesting habitat for the northern goshawk (*Accipiter agentus*), and hiding cover for white-tailed deer. Riparian areas provide habitat for neo-tropical migrants and resident species requiring moist or wet conditions. Predatory species, such as the black bear, mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereogentus*), are found over a wide range and in almost all habitat types. This is also true of the smaller omnivorous predators such as badgers (*Taxidea taxus*) skunks (*Mepitis mephitis* and *Spilogale putorius*), and weasels (*Mustela* spp.). Most of the rodent species found on the Forest are widespread residents of other National Forests and private lands.

3.1.1.2 Habitat Analysis Based on Land Cover Disturbance

Biodiversity (see Glossary), as applied and considered in this analysis, is based on the best information available for the specific habitat types found in the project area. There is limited data regarding relationships between wildlife and plant populations and the effects of oil and gas development. Most available data is either site-specific and/or species-specific, and thus any assessment of affects may be considered speculative. In addition, for the same reasons, the published data provide a wide range of recommendations for buffering raptor nest sites (Suter and Jones 1981, Bednarz 1984, Richardson and Miller 1997). This analysis investigates the relationship of human-induced disturbance through oil and gas exploration and development to selected habitat and/or life history aspects of species of concern. These are arrayed in terms of the projected disturbance to habitats as represented by related land cover types. Several recent court decisions have supported this approach to management concerning project analysis in relation to 36 CFR 219.19 [Inland Empire Public lands Council v. USFS, 88 F.3d 754, 760 (9th Cir. 1996) and Idaho Sporting Congress v. Thomas 137 F. 3d 1146 (9th Cir. 1998)] and for programmatic plans and the National Forest Management Act (NFMA) diversity provision [Northwest Forest Plan – Seattle Audubon Soc. v. Mosely, 871 F. Supp. 1291 (W.D. Wash. 1994) aff'd 80 F. 3d 1401 (9th Cir. 1996)].

For biodiversity analyses, the project area has been categorized into the following 13 general land cover categories:

1. Riparian (less than 1%)
2. Woody Draws (7%)
3. Sparse Grassland (9%)
4. Grassland (48%)
5. Seedling/Sapling (5%)

6. Post/pole (2%)
7. Sawlog, less than 40% crown cover (3%)
8. Sawlog, greater than 40% crown cover (4%)
9. Cottonwood (0.01%)
10. Aspen (0.06%)
11. Rimrock (12%)
12. Badlands (7%)
13. Water (0.01%)

The remaining area is comprised of developed special use areas (2 percent) and unclassified areas (0.26 percent).

Maps depicting the land cover for the five land units are shown in Figures 3.1.1 through 3.1.5 in the accompanying map packet.

1. Riparian Areas and 2. Woody Draws (8%)

The woody vegetation, shrubs, and trees result from moist conditions along perennial or intermittent streams and at the heads of draws. Woodlands in North and South Dakota only occur where there is sufficient soil moisture, north-facing slopes, intermittent drainage ways, creeks, springs, and floodplains. Lack of moisture is the most important limiting factor, but microenvironment, grass competition, fire suppression, grazing, and woodcutting have also influenced woodlands distribution (Girard et al. 1987). The lack of prescribed fire, in concert with fire suppression, may have had an even more important affect on woody draw distribution and function over the last 60 to 80 years.

Woody or hardwood draws are characterized by a varied species composition. The upper end of a draw may be covered with silver buffaloberry (*Shepherdia argentea* Nutt.) and western snowberry (*Symphoricarpos occidentalis* Hook), with chokecherry (*Prunus virginiana* L.), American plum (*Prunus americana* Marsh.), and hawthorn (*Crataegus* spp.) further down the draw. The more mesic portions of the draw support trees such as green ash (*Fraxinus pennsylvanica* March.), American elm (*Ulmus americana* L.), box elder (*Acer negundo*), along with lesser amounts of bur oak (*Quercus macrocarpa*), and quaking aspen (*Populus tremuloides*) (Severson and Boldt 1977). Other understory shrubs may include woods rose (*Rosa woodsii* Lindl.), serviceberry (*Amelanchier alnifolia* Nutt.), gooseberry (*Ribes setosum* Lindl.), and raspberry (*Rubus* spp.) (Boldt et al. 1973). Beaked sedge (*Carex sprengelii*) and northern bedstraw (*Galium boreale* L.) may also be present in the understories of healthy draws (Girard et al. 1987).

Riparian areas are important in maintaining vital habitat for many wildlife and fish species and maintaining water quality. Stream channels and shorelines are often stabilized by the riparian zone. (USFS 1987, p. 80.) Several wildlife species, especially amphibians requiring water for breeding and metamorphosing, and several neo-tropical bird migrants are wholly dependent upon this ecosystem.

3. Sparse Grasslands and 4. Grasslands (57%)

The project area is within a transition between the tall and short grass prairie and contains elements of the three divisions of grass heights. Vegetation that typically occurs in grassland areas of the project area includes western wheat grass (*Agropyron smithii*), green needlegrass (*Stipa viridula*), blue grama (*Bouteloua gracilis*), needle and thread grass (*Stipa comata*), bluebunch wheatgrass (*Agropyron spicatum*), little bluestem (*A. scoparius*), prairie sandreed (*Calamovilfa longifolia*), and sedge species (*Carex sp.*).

Sagebrush is an integral part of the grassland vegetation types. Big sagebrush (*Artemesia tridentata wyomingensis*) and silver sagebrush (*Artemesia cana*) are contained within the grasslands in the project area. These sagebrush types by definition may vary from 15 to 100 percent average canopy coverage by big and silver sage. There may be elements of each sagebrush species within a given vegetation type.

Existing areas of sagebrush grassland are not mapped as they are included within the areas identified as grassland land cover. However, the occurrence of sagebrush provides a necessary vegetative element for several species. Historic impacts of fire, livestock grazing, and plowing on sagebrush are assumed to have been proportionate across all land ownerships. Big sagebrush-dominated vegetation types generally show no recent evidence of fires.

Big sagebrush grasslands are associated with the heavier clay soil uplands. Silver sagebrush is associated with the coarse soil in stream bottoms, and fringed sagewort (*Artemesia frigida*) is an opportunistic species found in high and low productivity rangeland. Wyoming big sagebrush is especially palatable to wildlife including pronghorn antelope, mule deer, and sage grouse.

5. Seedling Sapings, 6. Post Pole, and 7./8. Saw Logs (14%)

Ponderosa pine (*Pinus ponderosa*) forest outlines the edges and bases of buttes and frequently above and below the rimrock cliffs.

Crown class can describe individual trees within a forest stand. Dominant and co-dominant trees typically are older, of larger diameter at breast height, and have larger crowns than intermediate or overtopped trees. Larger diameter mature ponderosa pine trees also have thicker bark that is more resistant to ground fires than smaller diameter trees.

The ponderosa pine landcover contains associated vegetation including common juniper (*Juniper communis*), western wild rose, Wolfberry (*Symphoricarpos occidentalis*), little bluestem, skunkbrush (*Rhus trilobata*), and chokecherry.

9. Cottonwood and 10. Aspen Forests (0.07%)

These deciduous forests types are located along streams or in other moist soil conditions in small units across the project area. Due to their function of creating an ecotone, these areas are typically more diverse in wildlife species than the adjacent grasslands or ponderosa pine forest.

11. Rimrock (12%)

These areas of sandstone outcrops and barren rock provide canyon interfaces with other habitat types. This provides canyon complexes with rocky cliffs that are used by raptors and other species as protected nesting/roosting areas.

12. Badlands (7%)

Badlands are areas of highly eroded barren terrain with sparse or no vegetative cover.

13. Water (0.01%)

Water areas consist of lakes, ponds, and reservoirs. These limited areas provide habitat for migrating waterfowl, amphibians, largemouth bass and other aquatic species as well as providing drinking water sources for terrestrial species.

3.1.1.3 Terrestrial Wildlife Species to be Addressed***Listed Species***

Listed species include species listed by the U. S. Department of Interior as threatened or endangered, or those formally proposed for such listing under the Endangered Species Act of 1978 (ESA). The State of South Dakota provided a list of sensitive species for the development of the Custer National Forest Land Management Plan (USFS 1987, p. 179). The State did not indicate addition of any additional species in their response to scoping.

The project area contains no occupied habitat nor designated critical habitat for any species listed as threatened or endangered under the ESA. Section 7(a)(1) of the ESA requires federal agencies to:

“ . . . utilize their authorities in furthering the purposes of the Act by carrying out programs for the conservation of endangered species and threatened species . . . ”

This requirement is addressed in FSM 2670.12, the Secretary of Agriculture’s Policy on Fish and Wildlife, which directs the Forest Service to:

- Manage habitats for all existing native and desired non-native plants, fish, and wildlife species in order to maintain at least viable populations of such species;
- Conduct activities and programs to assist in the identification and recovery of threatened and endangered plant and animal species; and
- Avoid actions that may cause a species to become threatened or endangered.

As required by Section 7(a)(1) of the ESA and upon request of the Custer National Forest, a list of species potentially occurring in the project area vicinity was requested of and provided by the U. S. Fish and Wildlife Service (USFWS 2002). A review of data provided by the Custer National Forest indicates none of these species or their critical habitats are apparently located within any of the five land units in the project area nor will they be affected by activities occurring there (USFS 1987, p. 179). Additionally, no species potentially occupying the project area are currently proposed for listing. Listed species identified by the USFWS in their response include:

Bald Eagle (*Haliaeetus leucocephalus*)—An endangered species that utilizes rivers, lakes, and reservoirs as nesting habitat. Stands of large trees, both conifer and hardwood, are used for winter roosts, particularly during winter months when eagles are foraging farther from water bodies. While the Custer National Forest has designated 41,500 acres as “Essential Habitat” for the bald eagle (USFS 1987, p. 179), no lands within the project areas are so designated. Bald eagles could temporarily and incidentally utilize riparian habitats having large cottonwoods or coniferous stands in the project area during migration, and during such time could occasionally forage on carrion, especially road-killed mammals within the project area. However, habitats in the project area are unsuitable for residency, either for breeding or long-term wintering use.

Black-footed Ferret (*Mustela nigripes*)—An endangered species formerly occupying much of the central plains and primarily associated with prairie-dog (*Cynomys* sp.) towns. As this species requires prairie dog colonies, the lack of these colonies in the project area precludes its residency. The acreage of active prairie dog towns in Harding County is not sufficient to support a viable population of black-footed ferrets (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, November 2002).

Black-tailed Prairie Dog (*Cynomys ludovicianus*)—In addition to the above-listed species, the U.S. Fish and Wildlife Service considers this species a candidate for listing due to the considerable reduction in suitable habitat and population complexes. However, there are no active or inactive prairie dog towns with open burrows on NFS lands (surface) or private surface/federal mineral estate within the project area. The project area is primarily located on buttes. A large portion of the project area contains slopes greater than 15 percent, rocky soils, and forested areas, which are considered unsuitable for prairie dog habitat (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, November 2002).

Forest Service Sensitive Species

The Chief of the Forest Service, through Forest Service Manual 2670, has directed the Regional Foresters to establish programs to identify Threatened, Endangered, and Sensitive Species occurring in the regions and to provide special management emphasis that will ensure their viability. Forest Service policy for threatened and endangered species is to manage their habitats to achieve recovery objectives so that special protection measures under the ESA are no longer necessary. For Sensitive Species, the Forest Service is directed to develop and implement management practices to ensure that these species do not become Threatened and Endangered.

Taxa for which viability is a concern, as evidenced by major current or predicted downward trends in population numbers or density, or considerable current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670), have been identified by the Regional Forester as sensitive. The Northern Region's Sensitive Species List (USFS 1999) contains 17 species known or suspected to inhabit the Custer National Forest. Of these, 13 may occur within the project area. These species are listed in Table 3.1-1.

Table 3.1-1. Forest Service Sensitive Species Located in the Project Area

Species	Land Cover	Habitat Requirements
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)	Rimrock	The species will utilize natural and man-made caves such as mine adits, abandoned buildings, and rock crevices where these are available (Reel et al. 1989).
Northern goshawk (<i>Accipiter gentiles</i>)	Ponderosa pine (mature) and mature aspen groves (Graham et. al 1994) Saw log >40% crown cover	30 acres (3 suitable and 3 replacement) totaling 180 acres per home range along drainages, bases of slopes, and on northerly aspects (Reynolds et al. 1992).
Baird's sparrow (<i>Ammodramus bairdii</i>)	Grassland	Lightly grazed or ungrazed grasslands (Goossen et al. 1993).
Burrowing owl (<i>Speotyto cunicularia</i>)	Grassland	Areas where small mammals create burrows in gently sloping areas characterized by sparse vegetation and bare ground such as moderately or heavily grazed pasture (MacCraken et al. 1985).
Sprague's pipit (<i>Anthus spragueii</i>)	Grassland	Closely associated with extensive tracts of mixed-grass prairies throughout the year. This vegetation should be of medium height, as this species avoids short-grass and tall-grass communities (Stewart 1975).
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Grasslands, woody draws	The species prefers open habitat characterized by grasses and forbs of low stature interspersed with bare ground and shrubs or low trees (Stewart 1975).
Northern leopard frog (<i>Rana pipiens</i>)	Riparian, water	Water areas in non-forested habitats. Vegetation is typically dense, as in a cattail marsh or dense sedge-meadow (Behler 1979).
Tawny Crescent Butterfly (<i>Phycodes batesi</i>)	Ponderosa pine/grassland	Found where woodlands meet the native grassland, especially prairie containing blue stem grasses (Royer and Marrone 1992).
Smooth goosefoot (<i>Chenopodium subglabrum</i>)	Early successional, sparsely vegetated habitat	Occupies loose sand associated with upland dunes or sandy river terraces. May require disturbance for persistence.

Table 3.1-1. Forest Service Sensitive Species Located in the Project Area (Cont'd)

Species	Land Cover	Habitat Requirements
Northern gentian (<i>Gentiana affinis</i>)	Grassland	Occupies wet meadows, shores, springs, and seepage areas in grasslands.
Mountain bluebells (<i>Mertensia ciliata</i>)	Ponderosa pine	Inhabits moist soils associated with springs, seeps, or watercourses in forested areas such as <i>Pinus ponderosa</i> . Habitat sometimes referred to as “damp thickets.”
Douglas’ dusty maiden (<i>Chaenactis douglasii</i>)	Scoria	Occupies exposed soils on dry clay slopes, or roadcuts through clay or scoria hills. May require disturbance for persistence.
Dakota buckwheat (<i>Eriogonum visherii</i>)	Scoria	Occupies barren, often bentonitic badland slopes and sandy outwash plains. May require disturbance for persistence.

There are known populations, historic records, and/or viable habitat for six USFS Region 1 sensitive plant species. These include three records for Douglas’ dusty maiden (*Chaenactis douglasii*), one record for smooth goosefoot (*Chenopodium subglabrum*), one record for Dakota buckwheat (*Eriogonum visherii*), one record for Mountain bluebells (*Mertensia ciliata*), and suitable habitat exists for Northern gentian (*Gentiana affinis*). All plant populations are less than two acres in size.

Bureau of Land Management Sensitive Species

The BLM policy on sensitive species designates the State Director with the authority to designate “Sensitive Species,” which are to be managed under the same policy as USFWS designated “Candidate” species. It is also BLM policy to carry out management for the conservation of state-listed plants and animals. The State Director is to develop policies that will assist the state in achieving its management objectives for those species. Lastly, the Bureau has developed a national plan, referred to as Fish and Wildlife 2000, a part of which details broad goals and objectives for the management of Threatened and Endangered species.

BLM Sensitive Species include taxa: (1) that are under status review by U. S. Fish and Wildlife Service/National Marine Fisheries Service, (2) whose numbers are declining so rapidly that federal listing might become necessary, (3) with typically small and widely dispersed populations, or (4) inhabiting ecological refugia or other specialized unique habitats (BLM Manual 6840, 9/16/88). BLM sensitive species present within the project area are listed in Table 3.1-2.

Table 3.1-2. BLM Sensitive Species Present Within the Project Area

BLM Sensitive Species	Land Cover	Habitat Requirements
<i>Mammals</i>		
Meadow jumping mouse (<i>Zapus hudsonius</i>)	Grassland, riparian	Grassy fields and thick vegetated areas bordering streams, ponds, or marshes (Knox and Birney 1988).
Merriam's shrew (<i>Sorex merriami</i>)	Grassland, woody draws	Arid regions with short grass prairie, sagebrush and surrounding grasslands, mixed woodlands (Mullican 1994).
Spotted skunk (<i>Spilogale putorius</i>)	Woody draws, riparian	Inhabits brushy, sparsely wooded areas, and areas along streams (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, November 2002).
Townsend's big-eared bat (<i>Plecotus townsendii</i>)	Rimrock	The species will utilize natural and man-made caves such as mine adits, abandoned buildings, and rock crevices where these are available (Reel et al. 1989).
<i>Birds</i>		
Burrowing owl (<i>Speotyto cunicularia</i>)	Grasslands	Areas where small mammals create burrows in gently sloping areas characterized by sparse vegetation and bare ground such as moderately or heavily grazed pasture (MacCracken et al. 1985).
Dickcissel (<i>Spiza americana</i>)	Grasslands	Grassland habitat having dense, moderate to tall vegetation (particularly with some forbs) and moderately deep litter (Winter et al. 2000).
Hairy woodpecker (<i>Picoides villosus</i>)	Woody draws, riparian, ponderosa pine	This species is a habitat generalist, preferring dense coniferous and mixed deciduous forest (Chipper Woods Bird Observatory, Inc. 1997).
LeConte's sparrow (<i>Ammodramus leconteii</i>)	Grasslands	Open, level uplands and lowlands, with tall, thick herbaceous vegetation and thick litter (Madden 1996).
Long billed curlew (<i>Numenius americanus</i>)	Grasslands	Breeds in short-grass communities, preferring native prairies but also occupying grazed mixed-grass communities and scrub prairie (Stewart 1975).

Forest Service Management Indicator Species (MIS)

The National Forest Management Act required Forests to identify Management Indicator Species and establish objectives to provide for their habitats. A management indicator species is any species of plant or animal that has been identified as a representative for a group of species with specific habitat requirements.

Custer National Forest indicator species in the project area are shown in Table 3.1-3.

Table 3.1-3. Habitats for Forest Service Indicator Species in the Project Area

Species	Land Cover	Land Units
Goshawk (<i>Accipiter gentilis</i>)	Old-growth ponderosa pine	North Cave Hills, South Cave Hills, Slim Buttes, West Short Pines, East Short Pines
White-tailed deer (<i>Odocoileus virginianus</i>)	“Dog-hair” ponderosa pine	North Cave Hills, South Cave Hills, Slim Buttes, West Short Pines, East Short Pines
Ruffed grouse (<i>Bonasa umbellus</i>)	Aspen	North Cave Hills, South Cave Hills,
Lark sparrow (<i>Chondestes grammacus</i>)	Open savannah (grasslands)	North Cave Hills, South Cave Hills, Slim Buttes, West Short Pines, East Short Pines
Northern oriole (<i>Icterus glabula</i>)	Riparian/tree	None
Yellow warbler (<i>Dendroica petechia</i>)	Riparian/shrub	North Cave Hills, South Cave Hills, West Short Pines, East Short Pines
Ovenbird (<i>Seiurus aurocapillus</i>)	Woody draw/tree	North Cave Hills, South Cave Hills, Slim Buttes, East Short Pines
Rufous-sided towhee (<i>Pipilo erythrophthalmus</i>)	Woody draw/shrub	North Cave Hills, South Cave Hills, Slim Buttes, East Short Pines
Brewer’s sparrow (<i>Spizella breweri</i>)	Sagebrush	No data
Sharptail grouse (<i>Tympanuchus phasianellus</i>)	Grassland	North Cave Hills, South Cave Hills, Slim Buttes, West Short Pines, East Short Pines
Large-mouth bass (<i>Micropterus salmoides</i>)	Warm water aquatic systems	North Cave Hills (Brown’s Pond)

Species of Specific Management Focus

Data provided by the Custer National Forest provides information on wildlife species and habitats that are of specific interest to the South Dakota Department of Game, Fish, and Parks (SDDGFP) and to the public in general. Such species include (but may not necessarily be limited to):

Golden Eagle (*Aquila chrysaetos*)—This large raptor occupies a wide variety of habitats at all elevations throughout its range. Nests are primarily located on cliffs with commanding views, and occasionally in large trees. Breeding occurs from mid-January to late September depending upon latitude, elevation, and local conditions. Peak nesting activity normally falls between April and July. These birds prey primarily on rabbits and hares, although pheasants, ducks, raptors, other large birds, fish, and small mammals are taken opportunistically (Olendorff 1975). Golden eagles nest in all four units of the project area (Hendricks and Dueholm 1995).

Prairie Falcon (*Falco mexicanus*)—Prairie falcons breed from central British Columbia, southern Alberta, Saskatchewan, and North Dakota south to Baja California. Found only in western North America, Baja, and northern Mexico, this is a falcon of open country that nests on rock cliffs in river gorges and occasionally in timbered mountains. Nests are often scraped on ledges although old stick nests of ravens or others raptors may be used. Reproductive activity usually begins in late winter or early spring. Prairie falcons feed on a variety of prey, including ground squirrels and prairie dogs, lizards, and birds, especially those that are ground dwelling. Immature birds eat

large quantities of insects (Bent 1937). Prairie falcons nest throughout the project area (Hendricks and Dueholm 1995, Hendricks and Feigley 1997).

Merlin (*Falco columbarius*)—Merlins are found worldwide, breeding in the northern latitudes and migrating south into Mexico and South America, the Mediterranean, the Middle East, and southern China. Nests are found in forests or scrublands that are broken up by open areas in which to hunt. Like other falcons, merlins do not build their own nests, but instead use the old stick nests of crows or magpies (Bent 1938). A study of merlin habitat utilization in southeastern Montana found exclusive use of ponderosa pine stands for nesting (Becker and Sieg 1987). Merlins feed primarily on small to medium-size birds, but will take insects, rodents, and small lizards (Mansel 1980). Merlins nest in selected sites within the project area (Hendricks and Dueholm 1995, Hendricks and Feigley 1997).

Owls—The SDDGFP comment letter (2002) indicated concerns for owl species in the project area. Most habitat types in the project area are suitable for one or more owl species. Available site-specific data indicates burrowing owls (a Forest Service and BLM sensitive species) and great horned owls (*Bubo virginianus*) (Hendricks and Feigley 1997) occupy the project area. Potential habitat exists for screech owl (*Otis asio*), long-eared owl (*Asio otis*), short-eared owl (*Asio flammeus*), northern saw-whet owl (*Aegolius funereus*), as well as wintering habitat for snowy owl (*Nyctea scandiaca*) (Robbins et al. 1966).

Prairie grouse—The Custer National Forest provides habitat for grouse species inhabiting grasslands. These include the greater prairie chicken (*Tympanuchus cupido*), the sharptail grouse (*Tympanuchus phasianellus*), and the sage grouse (*Centrocercus urophasianus*), although only the latter two are known to inhabit the project area. These species have a unique courting/breeding process: the males gather at established dancing grounds or “leks” where they display and attract females (Johnsgaard 1973).

Big game species—There are four species designated by the South Dakota Department of Game, Fish and Parks as big game: pronghorn, white-tailed deer, mule deer, and wild turkey.

- **Pronghorn** (*Antilocapra americana*)—Primarily utilize grasslands although may venture into open pine stands and aspen areas. The 1994 pronghorn population in Harding County was estimated at approximately 13,500 animals (Wrede 1995).
- **White-tailed deer** (*Odocoileus virginianus*)—Although the USFS (1986) indicates whitetailed deer populations are a result of a combination of four habitat components, diversity, forage, hiding cover, and thermal cover, this species has been designated as an MIS for low/mid-successional ponderosa stands. However, it utilizes many habitat components in the project area with the exception of grasslands that are not adjacent to hiding cover. Woody draws and riparian areas are also valuable habitat components.
- **Mule deer** (*Odocoileus hemionus*)—Habitat utilization in the Great Plains is diverse (Johnson and Strickland 1996). They may use all habitats in the project area with the exception of rocky outcrops.
- **Wild turkey** (*Meleagris gallopavo*)—Since wild turkeys are not native to Harding County (Rumble and Anderson 1993, Edminster 1954) a discussion of their contribution to natural biological diversity is moot. Ponderosa pine was found to be the major

habitat for wild turkeys in South Dakota (Rumble and Anderson 1993) with aspen, wet and dry meadows, and burr oak providing diversity (Rumble and Anderson 1995).

- **Aquatic species**—Species requiring permanent water
 - **Largemouth bass**—potential in Brown's Pond in North Cave Hills (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, November 2002).

3.1.1.4 Affected Environment by Unit

North Cave Hills

This unit consists of 14,420 acres with a high incidence of scoria/sandstone. Interfaces between this and other habitats (rimrock areas) provide ideal habitat for raptor nesting. There are 39 identified golden eagle nests; 15 identified merlin nests; and 24 prairie falcon nest sites located within this unit. These are primarily associated with areas of scoria/sandstone outcropping. There are 776 acres of ponderosa pine stands potentially suitable for goshawk occupancy within this unit. Currently, only one well exists adjacent to these stands. Woody draws are located throughout the unit. The area contains 9,744 acres of grasslands, most of which has the potential for grouse nesting. No leks have been identified in this unit. The area contains riparian vegetation in 10 drainages. There are no mapped juniper or aspen stands. North Cave Hills does not contain any known sensitive plant populations, as efforts to relocate a historic collection of smooth goosefoot and northern gentian were unsuccessful.

South Cave Hills

This 8,364-acre unit is primarily grassland, greater than 50 percent of which is suitable prairie grouse habitat. No lek sites have been identified. There is a high component of scoria/sandstone, especially in the southeast portion. Interfaces between this and adjacent grasslands provide suitable raptor nesting habitat. Records indicate 16 golden eagle, 11 merlin, and 10 prairie falcon nest locations. Drainages in the south and southeast show a high incidence of woody draws. There are a number of mature conifer stands (less than 15) scattered through the central and north portions of the unit that are potentially suitable for goshawk occupancy (See Reynolds et al. 1992, Braun et al. 1996). Riparian vegetation is found in seven drainages. One aspen stand of approximately 20 acres is located in the central portion; additional unmapped stands are also present. South Cave Hills does not contain any sensitive plant populations, although habitat exists for smooth goosefoot and northern gentian.

West Short Pines

This is a small unit consisting of 1,065 acres. The vegetative cover is, for the most part, mature ponderosa pine stands (greater than 50 percent) and grasslands (30 percent). Although no nests have been identified, these forested areas provide potential nesting habitat for northern goshawk. The grasslands are, for the most part, suitable for prairie grouse nesting. No leks have been identified. There are no scoria/sandstone outcrops in the unit; thus, raptor habitat is limited. A single golden eagle nest and a single merlin nest have been identified here. A small amount (less than 20 acres) of woody draw habitat is located in the northeast and south-central portions of the unit and riparian vegetation is located in one drainage. No other vegetative types have been

mapped. West Short Pines does not contain any known sensitive plant populations, as efforts to relocate a historic collection of mountain bluebells were unsuccessful.

East Short Pines

This 6,074-acre unit is primarily grassland (48 percent), mature ponderosa pine (28 percent), and scoria/sandstone (20 percent). Grassland habitats are, for the most part, within nesting habitat suitability for prairie grouse. However, no leks have been identified in this unit. The rocky outcrops, while extensive, only provide for a single golden eagle nest site, two merlin, and one prairie falcon nest sites. Mature ponderosa pine forest habitat provides potential habitat for northern goshawk nesting. Riparian vegetation occurs in two short drainages. Aspen occurs in several small stands throughout the unit. Small areas of juniper also occur in the north central area. East Short Pines contains one population of smooth goosefoot.

Slim Buttes

At 43,574 acres, this is the largest unit in the project area. The area is greater than 51 percent grassland interspersed with small ponderosa pine stands, woody draws, and bare soils. There is an important interface of scoria/sandstone, with the grassland providing for 45 golden eagle nests, 25 prairie falcon nest sites, 1 goshawk nest, and 8 merlin nest sites. Most grassland habitats provide suitable nesting habitat for prairie grouse. One active lek has been identified. There are 14 drainages containing riparian vegetation throughout this unit. Slim Buttes is the most botanically diverse unit, with five sensitive plant populations. These include three populations of Douglas' dusty maiden, one population of mountain bluebells, and one population of Dakota buckwheat.

3.1.2 ENVIRONMENTAL EFFECTS

Assessment of effects to wildlife species from human-induced activity is rarely straightforward, especially the assessment of non-lethal effects to habitat quality. Many wildlife species portray a wide variation in response to human-induced disturbances. Such variations are the result of a number of factors that include: a species' activity cycle; habituation to disturbance; individual temperament; sum of additional stress factors; type and level of disturbance; and numerous other factors. Thus, determination of actual effects is, at best, speculative and based on data often unrelated to the activity in question.

3.1.2.1 General Impacts from Oil & Gas Development

Development of oil and gas reserves may result in both direct and indirect impacts common to most construction projects. Such impacts may include disturbance from human activity, noise, and vehicular travel. Activities involving construction and use of mechanized equipment may increase air pollution, water pollution, and result in short- and long-term vegetative disturbance. Periodic maintenance activities and the maintenance of roads may result in temporary impacts to biological resources, primarily in the form of noise, vehicular operation, and human activity.

Unpredicted catastrophic events, such as wildfire, flood, earthquake, and certain types of equipment failure, may result in immediate and long-lasting adverse impacts. These could include degradation of terrestrial habitat, pollution of waters, and release of toxics. Such events may require considerable periods of time and activity to repair, replace, or mitigate.

3.1.2.2 Potential Impacts to Wildlife (Terrestrial)¹

Direct Effects - Mortality Directly Resulting from an Incident

Vehicular Collision—Introduction of heavy construction equipment and repetitious vehicular travel into remote areas increases the vulnerability of wildlife to death by crushing and/or collision. Construction and maintenance worker traffic on secondary roads through occupied habitats normally results in variable and continuing wildlife collision mortality.

Collision With Facilities—Migrating and resident birds are known to collide with structures that interfere with their flight paths. Golden eagles, falcons, and other raptors have been killed in collisions with power lines.

Oil Pits—A number of studies have documented wildlife losses associated with oil pits, ponds, and reservoirs containing oil. Losses occur through entrapment, ingestion of oil, and/or loss of insulation resulting in thermal stress (USFWS 2000).

Contamination—Accidental spills of petroleum compounds may directly kill wildlife through contact and/or ingestion and by reducing mobility through the coating of feathers or in their becoming mired in pools of oil, resulting in exposure, suffocation, and/or starvation.

Indirect Effects – Mortality Resulting from Habitat Loss, Degradation, or Human Disturbance

Habitat Loss—Access roads, drilling pads, pump sites, storage tanks, and pipelines all reduce the habitat available for wildlife use. Certain of these activities can be mitigated through site restoration and the planting of vegetation preferable to wildlife species (forage and cover species). Considering the high degree of disturbance caused by the current level of human activities to wildlife species and habitat near existing transportation routes, any incremental increase in negative impacts, short-term or long-term, such as additional roads, developments, or resource extraction, will have the cumulative effect of reducing wildlife habitat (Craighead 2002, Trombulak and Frissell 2000).

Disturbance—Heavy equipment, vehicular travel, and associated noise pose a considerable disturbance factor to species adjacent to and within a certain distance of these roads, drill sites, and other areas frequented by workers or noise-producing equipment. (Helldin and Seiler n.d., Memphis State University 1971, Mead 1999, Nature Sounds Society n.d., Radle n.d., Ritchie and Anderson 1997, Stone 2003.)

Pipelines—Exposed pipelines can pose a barrier to wildlife species, preventing them from normal movements within their habitats (Schoen 2002).

¹ Those species not requiring seasonal or permanent water for breeding and reproduction.

Pollution

Spills—Indirectly, spillage of petroleum products can render vegetation unpalatable for ingestion, reduce or eliminate soil productivity for sensitive and forage plants, and reduce palatability of water.

Drilling muds extracted during well excavations may contain toxic substances that can leach into drainages.

Dust—Dust from construction activities and vehicular traffic on unpaved roads adjacent to vegetation can render such vegetation unpalatable or unavailable for wildlife use.

Emissions—Engine emissions from vehicles, generators, pumps, and other internal combustion engines release toxic gases into the air. Many of these emission sources are not required to have catalytic converters or scrubbers.

3.1.2.3 Potential Impacts to Wildlife (Aquatic)²

Direct Effects

Mortality—Accidental spillage of petroleum products or other toxic materials can directly kill aquatic species (frogs and toads). Eggs may be smothered or killed, and larvae and adults killed. During specific periods, aquatic species may migrate from upland habitats to ponds and streams for reproductive purposes. At this time, they are vulnerable to mortality on roads. During dry summer or cold winter months, species may become dormant or hibernate in burrows. This renders them vulnerable to crushing by heavy equipment activity.

Habitat Loss/Degradation—Aquatic habitats, including seasonal wetlands, are fragile ecosystems extremely prone to disturbance. Alteration of surface water run-off, interception of sub-surface sources, or depletion of ground water will result in losses of aquatic ecosystems. Siltation of water sources can fill in aquatic habitats, displacing species, burying hiding cover, and eliminating food sources.

Disturbance—Temporary or permanent crossing of wet areas and streams can disturb species and preclude use of certain areas.

Pollution—Accidental spills of toxic substances can render aquatic habitats unsuitable for use by wildlife. Small amounts of toxic material can affect vulnerable species, particularly amphibians. Minor amounts of petroleum can suffocate aquatic insect larvae necessary as a food source for these species.

Indirect Effects

Dewatering—Petroleum exploration and extraction activities have the potential to intercept groundwater sources, through rechanneling or extraction, resulting in reductions of surface water in aquatic habitats.

² Those species requiring water for breeding and/or reproduction, exclusive of fish.

3.1.2.4 Potential Impacts to Vegetation

Direct Impacts

Oil and gas exploration and development generally progresses through three operational phases: (1) preliminary exploration, (2) exploratory drilling, and (3) development, production, and abandonment. The preliminary investigations often require only “casual” surface presence, but off-road vehicle travel and some access road construction can occur, particularly if seismic reflection or geophysical surveys are used in exploration. This could result in vehicular damage to unfenced sensitive plant populations.

Potential impacts of oil and gas development on botanical resources are greatest during exploratory drilling and oil/gas field development phases. These phases can last up to 50 years. Direct surface disturbance to vegetation and topsoil results from the construction of access roads, well pads, and associated features. Total vegetation disturbance within an individual field depends upon well spacing that can vary considerably depending upon the quality of the oil or gas field. The well pads and other facilities would not have the topsoil replaced and be revegetated until well abandonment (i.e., for up to 50 years from the start of development).

Indirect impacts during exploratory drilling and development could occur through disposal of spent muds, cuttings and fluids from the well bore, and changes in drainage. These would affect moisture requirements for sensitive species regeneration, accelerated erosion resulting in sedimentation of downslope habitats, and introduction or spread of non-native plants during construction and reclamation activities. Dust from road activity can coat plants reducing their vigor. Reduction in or interception of ground water could result in water quantity and quality degradation.

Potential for Effect

A sensitivity analysis was conducted on species listed as endangered, threatened, sensitive, or indicator species located in the project area (Technical Report: Oil and Gas Leasing Impacts Upon Biodiversity of the North & South Cave Hills, Slim Buttes, and East & West Short Pines Land Units, TetraTech FW, Inc. 2003, on file in the Custer National Forest Supervisor’s Office). The analysis was based on information provided by the Forest Service regarding the project area, published data regarding the ecology of the involved species, the RFD projected activities of oil and gas development, numerous discussions with FS Biologist Donald Sasse and professional judgment. The analysis estimated the sensitivity of these species to the projected oil and gas exploration and development activities. The resulting sensitivity data was used to estimate the environmental consequences of the various alternatives considered and in developing mitigation measures. Unless otherwise known, the quality of land cover types were assumed to be suitable to provide for individual species habitat requirements. The land cover types were also assumed to be uniformly distributed over the area they were identified as occupying.

Projections of effects to the viability of species listed as sensitive on Update of the Forest Service Northern Region Sensitive Species List (Bosworth, March 12, 1999) were made based on the same data and information (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, March 2003). Options in projecting effects to sensitive species are based on Salwasser and Bosworth (1991, Aug. 17) (personal communication, Don Sasse, Wildlife

Biologist, Custer National Forest, March 2003). The results, shown in Table 3.1-4, do not vary by alternative. The results indicate either no impact or lease activities may impact individuals or habitat, but will not likely contribute to a trend towards federal listing, or cause a loss of viability to the population or listed FS sensitive species.

Table 3.1-4 Estimates of Effects to Forest Service Sensitive Species¹

Species	Land Cover Types	Projected Effects
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	NA	NI
Black-footed Ferret (<i>Mustela nigripes</i>)	NA	NI
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)	Rimrock	NI
Black-tailed Prairie Dog (<i>Cynomys ludovicianus</i>)	Grassland	MIIH
Northern goshawk (<i>Accipiter gentiles</i>)	Sawlog, greater than 40% crown cover	NI
Baird's sparrow (<i>Ammodramus bairdii</i>)	Grassland	MIIH
Burrowing owl (<i>Speotyto cunicularia</i>)	Grassland	MIIH
Sprague's pipit (<i>Anthus spragueii</i>)	Grassland	MIIH
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Grassland, Woody Draws	MIIH
Northern leopard frog (<i>Rana pipiens</i>)	Riparian, Water	NI
Tawny Crescent Butterfly (<i>Phyciodes batesi</i>)	Grassland, Seedling/Sapling, Post/pole, Sawlog,	MIIH
Smooth goosefoot (<i>Chenopodium subglabrum</i>)	Riparian, Sparse Grassland	NI
Northern gentian (<i>Gentiana affinis</i>)	Riparian, Grassland	MIIH
Mountain bluebells (<i>Mertensia ciliata</i>)	Riparian, Woody Draws	NI
Douglas' dusty maiden (<i>Chaenactis douglasii</i>)	Sparse Grassland, Badlands	NI
Dakota buckwheat (<i>Eriogonum visherii</i>)	Badlands	NI

NI = No impact. WIFV = Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population of species. MIIH = May impact individuals or habitat, but will not likely contribute to a trend towards federal listing, or cause a loss of viability to the population or species. BI = Beneficial.

¹ There would be "no impact" to sensitive species determined to be absent from the project area and not included in this table.

3.1.2.5 Alternative 1 – No Action, No New Leases

This alternative allows existing leases to continue but prohibits issuing any new leases. Only the North and South Cave Hills land units have existing oil and gas leases. Existing lease stipulations, shown in Table 2-4 and mapped in Figures 2.01 through 2.06, provide for timing limitations (TL) for nesting raptors and no surface occupancy (NSO) within riparian and woody draw areas. Table 3.1-5 is a summary of the habitat by land cover that would be disturbed under the Alternative 1 leasing RFD scenario.

North Cave Hills

There are currently 13 golden eagle nests, 7 prairie falcon nests, and 5 merlin nests that are within or immediately adjacent to existing lease boundaries. Much of the mature ponderosa pine habitat occurs within the existing lease boundaries, as does a large complex of woody draws. Grassland habitats within existing leases provide some suitable grouse nesting habitats. There are no aspen or juniper areas within the existing lease boundaries.

There are two separate existing lease blocks within this unit, one large block at the north end and a smaller block in the middle. For these lease blocks, existing stipulations restrict occupancy on portions of the lease areas while imparting both controlled surface use and timing restrictions on other areas. NSO is required in the north block for all hardwood draw, ponderosa steep, and rimrock ecosystems. The middle block has NSO restrictions on 11 percent of the area to protect hardwood draws and rimrock habitats. Thirty percent of the block is within timing restrictions for raptor nest protection and an additional five percent is in conditional surface occupancy status.

There are two existing wells within this unit and associated service roads, which, based on current level of oil and gas production and facilities maintenance, are thought to have limited environmental effect (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, November 2002). The RFD projects one injection and one producing well for the existing leases in the North Cave Hills land unit as shown in Figure 2.05 in the accompanying map packet. Neither projected well location is in conflict with known biological resources.

The projected RFD wells and roads would disturb 16 acres of grassland, 0.8 acres of riparian, and 0.2 acres of sparse grassland in North Cave Hills. This represents only 0.21 percent of the grasslands, 0.28 percent of the riparian, and 0.16 percent of the sparse grassland in the land unit. The projected new wells and roads in North Cave Hills disturb no other land cover type.

South Cave Hills

Ten golden eagle nests, 3 prairie falcon nests, and 9 merlin nests occur within or adjacent to existing lease boundaries. Several small stands of mature ponderosa pine and woody draws are also located within existing leases. Grassland habitat within the lease boundaries contains a high percentage of suitable prairie grouse nesting habitat. There are no juniper stands, aspen, or riparian areas within the existing lease boundaries.

Existing lease stipulations restrict occupancy on a large portion of the lease area while imparting both conditional surface use and timing limitations on much of the remainder.

There is one existing well on NFS land and one on private land with federal minerals within this lease. Its effects on native wildlife in this area are thought to be minor (personal communication, Don Sasse, Wildlife Biologist, Custer National Forest, November 2002).

The RFD projects two producing oil wells and one injection well within the existing leases in the South Cave Hills land unit. Two of the well locations are within one-quarter mile of known raptor nests as shown in Figure 2.06 in the accompanying map packet. Potential impacts to these raptors could occur during the oil and gas exploration phase.

Tables 3.1-5a-c. Alternative 1: Summary of Land Cover Affected

A. Acres of Vegetation Cover by Land Unit

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills		22		7,722	161	137	1,941	130	292	776		2,022	132	9	1,077	14,420
S Cave Hills	3			5,021	0	2	1,144	88	466	160		1,152			327	8,364
Slim Buttes	5	4,962	11	19,370	27	1,670	4,578	172	667	574	3,733	2,843	1,316		3,648	43,574
W Short Pines		25		283	0		86	4	112	536					20	1,065
E Short Pines	37			2,621	0	10	1,198	8	618	1,088		308			186	6,074
Total	46	5,009	11	35,017	188	1,819	8,946	401	2,155	3,134	3,733	6,325	1,448	9	5,257	73,497
Percent	0.1%	6.8%	0.0%	47.6%	0.3%	2.5%	12.2%	0.5%	2.9%	4.3%	5.1%	8.6%	2.0%	0.0%	7.2%	100.0%

B. Acres of Vegetation Affected by Wells and Roads (Existing and RFD)

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills				16.0				0.8				0.2				17.1
S Cave Hills				14.4												14.4
Slim Buttes																
W Short Pines																
E Short Pines																
Total				30.4				0.8				0.2				31.4

C. Percentage of Vegetation Affected

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills				0.21%				0.28%				0.16%				0.12%
S Cave Hills				0.29%												0.17%
Slim Buttes																
W Short Pines																
E Short Pines																
Total				0.09%				0.04%				0.01%				0.04%

The TL would not apply if exploration leads to a development and exploration phase. This stipulation only allows seismic work and well drilling within one-quarter mile of active nests during the period from August 1 to March 1 annually. There would be 14 acres of grassland disturbed by the new wells and roads projected by the RFD. No other land cover type would be disturbed.

West Short Pines

There are currently no existing leases in this unit.

East Short Pines

There are currently no existing leases in this unit.

Slim Buttes

There are currently no existing leases in this unit.

Direct Affects

Given the limited current and projected future oil and gas activity in the areas currently under lease, overall direct effects of this alternative appear to be negligible. Sixteen acres of grassland in North Cave Hills and 14 acres of grassland in South Cave Hills would be disturbed given the RFD scenario. All other habitat types are not directly impacted except for less than an acre of riparian area in North Cave Hills where an existing well is located. Vehicular activity on existing roads as a result of maintenance and potential additional development activities may expose individuals of several species of wildlife to direct mortality by collision

Indirect Effects

Noise generated by construction machinery, blasting, vehicular use on roads, and in some cases, simply human presence, have been noted to produce varying effects on mammals and birds. Effects appear to be especially detrimental during critical periods such as breeding, nesting and/or fawning. Numerous studies noted that birds and mammal species avoid roaded areas, the extent of avoidance depending on the species, the individual, its activity, the intensity of vehicular activity, the type of activity, the presence or absence of topographic barriers, and other as yet undetermined factors. Such effects are difficult to quantify but should be expected to be minor given the limited amount of activities projected and minor amount of habitat disturbed. Many species are noted to become habituated to varying degrees of human activity and mechanized noise. In several cases on the Custer and other locations, raptorial birds appear to have repeatedly nested and forage within close proximity to existing wells, roads, and other petroleum activity sites (Squires et al. 1993)

Other indirect impacts may be expected as a result of increased human presence especially during exploration and construction. Noise and visual presence can be disruptive to many species. Sites developed under the existing lease stipulations have not been monitored to determine their effectiveness. No potential effects to sensitive plant populations are projected in the North Cave Hills and South Cave Hills units since there are no known records of occurrence. If new populations are discovered during surveys required at the APD stage, they will be protected, to the extent possible, by relocating facilities up to 200 meters.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible effects to wildlife. Minor amounts of grassland habitat may be irretrievably altered for the term of the lease. However, once the lease is completed, habitat restoration will be required to restore habitats to near natural conditions.

Cumulative Effects

Table 3.1-5 indicates only the grassland and riparian land cover types would be impacted. The impact to the riparian area is from an existing well. There has been no documented substantial impact to wildlife from the existing wells over the past 20 plus years. The only projected additional habitat impact for Alternative 1 is to 31 acres of grassland. This represents less than one percent of the grasslands in the two land units. The limited amount of grassland habitat disturbance coupled with the limited amount of other reasonably foreseeable projects identified has not been determined to result in cumulative impacts that would jeopardize any of the species of concern. When compared to all available grasslands under various ownerships the effect appears to be negligible.

The State of South Dakota Department of Fish and Game has proposed a project for statewide sage grouse conservation. The project is intended to have a positive effect on sage grouse and thus will not contribute to adverse cumulative effects.

3.1.2.6 Alternative 2 - Lease with Forest Plan Stipulations

Table 3.1-6 is a summary of the habitat by land cover that would be disturbed under the Alternative 2 leasing scenario. Figures 2.07 through 2.23 (located in the accompanying map packet) show the stipulations that apply for Alternative 2 and show the locations of the projected RFD wells and roads. The Alternative 2 stipulations specified by the Custer Forest Plan, as amended, are listed in Chapter 2. Table 3.1-7 shows the acres of associated landform type disturbed under Alternative 2 for Forest Service Sensitive and Forest Service Indicator Species given the RFD well projections.

Under the Alternative 2 scenario, RFD-projected new roads and well sites have been relocated, as necessary, to avoid sensitive resources protected by NSO stipulations. One well in Slim Buttes was eliminated due to the proposed deer Draw Research Natural Area.

North Cave Hills

Management Area (MA) E (Minerals Management) predominates in this unit, with Management Areas C (Rimrock), N (Woody Draws), and M (Riparian) covering the remainder. MA-C is protected by an NSO stipulation. MA-M is protected by a Lease Notice (LN) under SLTs requiring a 200-meter buffer area either side of the center of riparian areas. Woody draws are protected by a CSU stipulation. Twelve additional well sites (six injector, six oil) are projected. Of these, none are within TL or NSO buffers for nesting raptors or prairie grouse. The access road to one projected well is partially within ½-mile TL zones for nesting eagles. All the land projected to be disturbed is in grasslands land cover type. This represents less than one percent of the grasslands in North Cave Hills. As can be seen on the Alternative 2 Composite Stipulation Map, Figure 2.07 in the accompanying map packet, all of the RFD-projected roads and wells have been located in areas needing only standard lease terms (or in one case timing limitations as

well) to protect surface resources. No surface occupancy (NSO) stipulations protect much of the North Cave Hills land unit as shown in Figure 2.07. The underlying Alternative 2 biological stipulations are shown in Figure 2.17 in the accompanying map packet. The projected wells and roads would disturb 49 acres, which represents only 0.6 percent of the grassland in North Cave Hills.

South Cave Hills

Management of this unit is predominately under Management Area B (Range) with considerable areas of Management Area C (Rimrock) and Management Area M, (Riparian). The area contains 10 projected well sites. As can be seen on the Alternative 2 Composite Stipulation Map, Figure 2.08 in the accompanying map packet, one proposed injector well and one proposed oil well fall within the ½-mile TL buffer area for golden eagle nesting. Access roads to these sites already exist; however, TL restrictions will apply to them. No surface occupancy stipulations protect much of the South Cave Hills land cover as shown in Figure 2.08. The underlying Alternative 2 biological stipulations are shown in Figure 2.18 in the accompanying map packet. The projected new wells and roads would disturb 35 acres of grassland, which represents only 0.9 percent of the grassland in North Cave Hills. Grassland is the only land cover type that would be directly disturbed by projected new wells.

Slim Buttes

Management Area B (Range) dominates this unit. In addition, Management Area C covers all rimrock areas, and a small area of Management Area D (Wildlife) occurs near the north end. The unit also contains a number of drainages with Management Area M (Riparian) and Management Area N (Woody Draws) designation. No surface occupancy stipulations protect much of Slim Buttes land cover as shown in Figures 2.09 and 2.10 in the accompanying map packet. The underlying Alternative 2 biological stipulations are shown in Figures 2.19 and 2.20 in the accompanying map packet. One RFD-projected well site was eliminated in this unit due to a location within the proposed Deer Draw Research Natural Area, Management Area L, which is NSO. Another well is projected to be located off forest. This leaves two projected well sites in this unit, all of which fall within Management Area D, CSU stipulations area, which allows further constraints on development if identified as needed during required surveys at the APD stage. There is one prairie grouse lek within this unit, which is protected by a 200-foot NSO buffer and a TL buffer area for ¼ mile around the lek. Furthermore, no RFD-projected well sites are within a distance to adversely affect the lek and its use.

The two projected wells and access roads would disturb 6.1 acres of grassland (0.9 percent), 3.7 acres of seedling/saplings (0.1 percent), and 0.5 acres of ponderosa pine with greater than 40 percent crown cover (0.1 percent).

There are five sensitive plant locations in the Slim Buttes unit, but these will not be affected by the projected well sites due to protection under SLTs.

Table 3.1-6a-c. Alternative 2: Summary of Land Cover Affected

A. Acres of Vegetation Cover by Land Unit

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills		22		7,722	161	137	1,941	130	292	776		2,022	132	9	1,077	14,420
S Cave Hills	3			5,021	0	2	1,144	88	466	160		1,152			327	8,364
Slim Buttes	5	4,962	11	19,370	27	1,670	4,578	172	667	574	3,733	2,843	1,316		3,648	43,574
W Short Pines		25		283	0		86	4	112	536					20	1,065
E Short Pines	37			2,621	0	10	1,198	8	618	1,088		308			186	6,074
Total	46	5,009	11	35,017	188	1,819	8,946	401	2,155	3,134	3,733	6,325	1,448	9	5,257	73,497
Percent	0.1%	6.8%	0.0%	47.6%	0.3%	2.5%	12.2%	0.5%	2.9%	4.3%	5.1%	8.6%	2.0%	0.0%	7.2%	100.0%

B. Acres of Vegetation Affected by Wells and Roads (Existing and RFD)

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills				48.8				0.8	0.1			3.3				53.0
S Cave Hills				31.9			0.3					2.8			0.2	35.2
Slim Buttes				3.0		0.3				2.4					1.0	6.7
W Short Pines				5.0					0.0	1.3						6.4
E Short Pines				3.3												3.3
Total				92.0		0.3	0.3	0.8	0.1	3.8		6.1			1.2	104.6

C. Percentage of Vegetation Affected

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills				0.63%				0.63%	0.03%			0.17%				0.37%
S Cave Hills				0.63%			0.03%					0.24%			0.07%	0.42%
Slim Buttes				0.02%		0.02%				0.42%					0.03%	
W Short Pines				1.78%					0.04%	0.25%						
E Short Pines				0.13%												
Total				0.26%	0.00%	0.02%	0.00%	0.20%	0.01%	0.12%		0.10%			0.02%	0.14%

Table 3.1-7. Projected Effects of Alternative 2 on FS Sensitive and FS Indicator Species Habitat

Species	Land Cover Type	Habitat Acres Affected by Project Unit					Comments
		North Cave Hills	South Cave Hills	Slim Buttes	West Short Pines	East Short Pines	
Whitetail deer	Riparian, Woody Draws, Seedlings, Post/pole	0.8	0.0	1.3	0.0	0.0	Exceptionally adaptable to human activity; a LN protects 200 meters either side of stream courses under SLTs; Woody Draws are protected by a CSU stipulation.
Northern oriole	Riparian	0.8	0.0	0.0	0.0	0.0	A LN protects 200 meters either side of stream courses under SLTs.
Yellow warbler	Riparian	0.8	0.0	0.0	0.0	0.0	A LN protects 200 meters either side of stream courses under SLTs.
Northern leopard frog	Riparian, Water	0.8	0.0	0.0	0.0	0.0	A LN protects 200 meters either side of stream courses under SLTs.
Ovenbird	Woody Draws	0.0	0.2	0.1	0.0	0.0	Woody Draws are protected by a CSU stipulation.
Rufous-sided towhee	Woody Draws	0.0	0.2	0.1	0.0	0.0	Woody Draws are protected by a CSU stipulation.
Loggerhead shrike	Woody Draws, Sparse Grassland, Grassland	52.1	34.9	3.1	5.0	3.3	Woody Draws are protected by a CSU stipulation. Surveys and mitigation would be required in grasslands under SLTs.
Burrowing owl	Sparse Grassland	3.3	2.8	0.0	0.0	0.0	Surveys and mitigation would be required in grasslands under SLTs.
Baird's sparrow	Sparse Grassland, Grassland	52.1	34.7	3.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Sharptail grouse	Sparse Grassland, Grassland	52.1	34.7	3.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Sprague's pipit	Grassland	48.8	31.9	3.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Lark sparrow	Grassland	48.8	31.9	3.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Brewer's sparrow	Grassland	48.8	31.9	3.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.

Table 3.1-7. Projected Effects of Alternative 2 on FS Sensitive and FS Indicator Species Habitat (Cont'd)

Species	Land Cover Type	Habitat Acres Affected by Project Unit					Comments
		North Cave Hills	South Cave Hills	Slim Buttes	West Short Pines	East Short Pines	
Northern goshawk	Sawlog >40% Crown	0.0	0.0	2.4	1.3	0.0	A CSU stipulation protects forested areas in MA's B, D, & E
Ruffed grouse	Aspen	0.0	0.0	0.0	0.0	0.0	A CSU stipulation protects forested areas in MA's B, D, & E
Townsend's big-eared	Rimrock	0.0	0.3	0.0	0.0	0.0	Potential habitat only in MA C where NSO applies.
Largemouth bass	Water	0.0	0.0	0.0	0.0	0.0	A LN protects 200 meters either side of stream courses under SLTs.
Smooth goosefoot	Riparian, Sparse Grassland	4.1	2.8	0.0	0.0	0.0	A LN protects 200 meters either side of stream courses under SLTs.
Northern gentian	Riparian, Grassland	49.6	31.9	3.0	5.0	3.3	A LN protects 200 meters either side of stream courses under SLTs.
Mountain bluebells	Riparian, Woody Draws	0.8	2	0.1	0.0	0.0	A LN protects 200 meters either side of stream courses under SLTs. A CSU stipulation protects woody draws.
Douglas' dusty maiden	Sparse Grassland, Badlands	3.3	3.8	0.0	0.0	0.0	Surveys would be required under and lessees would be required to mitigate impacts under SLTs.
Dakota buckwheat	Badlands	0.0	0.0	0.0	0.0	0.0	Surveys would be required under and lessees would be required to mitigate impacts under SLTs.

West Short Pines

The predominant management strategy for this unit is Management Area D (Wildlife) with areas of Management Area C (Rimrock) and Management Area M (Riparian). As can be seen on the Alternative 2 Composite Stipulation Map, Figure 2.11 in the accompanying map packet, all of the RFD projected roads and wells have been located in areas needing only standard lease terms, and in case of five wells, timing limitations as well. No surface occupancy stipulations protect much of the West Short Pines land cover as shown in Figure 2.11. The underlying Alternative 2 biological stipulations are shown in Figure 2.21 in the accompanying map packet. The two projected well sites are both within Management Area D (Wildlife) where CSU restrictions could be applied to protect wildlife concerns if necessary. Both projected wells and roads are predominately within the grassland land cover type (5.0 acres or 1.8 percent). One well extends

slightly (0.8 acres or 0.09 percent) into the ponderosa pine with crown closure greater than 40 percent land cover type.

East Short Pines

The predominant management strategies for this unit is Management Area C (Rimrock requiring NSO) and forested areas restricted to Management Area CSU. As can be seen on the Alternative 2 Composite Stipulation Map, Figure 2.11 in the accompanying map packet, there is only one projected gas well within this unit, and it falls within the grassland habitat. There are no projected RFD roads or other developments that would affect sensitive biological resources.

Direct Effects and Indirect Effects

Table 3.1-7 shows the acres of associated landform type disturbed under Alternative 2 for Forest Service Sensitive and Forest Service Indicator Species.

Given the limited current and projected future oil and gas activity in the land units, effects of this alternative on biodiversity are expected to be minimal. The woody draws, proposed Deer Draw RNA, and rimrock are protected by NSO stipulations. Both NSO and TL stipulations further protect raptors from indirect impacts. Ninety-eight acres or 94 percent of projected disturbed area is in the grassland/sparse grassland land cover type. These 98 acres of grassland represents only two-tenths of 1 percent of the total grasslands in the five land units. Other landform types that are projected to be disturbed include ponderosa pine with crown closure greater than 40 percent (3.8 acres or 0.12 percent). The only impact to riparian areas is from an existing well. As a result, only grassland-associated species would potentially be affected. Given the very small percent of the grassland affected and the amount of grassland in the land units and surrounding areas, the impact is expected to be negligible.

Vehicular activity on existing roads as a result of maintenance and potential additional development activities may expose individuals of species of concern to direct mortality by collision. However, such effects, while not quantifiable, are expected to be inconsequential given the limited amount of development reasonably foreseeable and the small amount of resultant traffic. Roads will be closed to public use, allowing wildlife species to become habituated to human-induced activities. Raptors have previously nested successfully within the projected timing limit distances of existing wells in the project area. Increased activity could result in temporary avoidance of areas and, in extreme cases, isolated instances of an individual's death. However, given the scope of the project and the activities involved, such effects are likely to be negligible.

Potential effects to sensitive plant populations in the East Short Pines and Slim Buttes units are negligible, as these populations will be avoided. These and any new populations identified during APD surveys would be protected by the CSU stipulations for MA-D and SLTs.

Irreversible and Irrecoverable Commitment of Resources

There are no irreversible effects to wildlife expected. Minor amounts of habitats will be irretrievably altered for the term of the leases to the extent shown in Table 3.1-7. Once the leases are completed, habitat restoration is required to restore habitats to near natural conditions.

Cumulative Effects

As can be seen by Table 3.1-6, for the most part, only the grassland and riparian land cover types are projected to be affected. The impact to the riparian area is from one of the existing wells, and there has been no documentation of substantial impact to wildlife from the existing wells over the past 20 plus years. The LN is expected to protect riparian habitat. As a result, the only additional habitat impact for Alternative 2 is essentially 98 acres of grassland, which represents only two-tenths of one percent of the grasslands in the five land units. Given this very small amount of grassland habitat disturbance coupled with the limited amount of other reasonably foreseeable projects identified and the vast amount of grasslands surrounding the five land units, it is not expected to result in cumulative impacts that would jeopardize any of the species of concern

The State of South Dakota Department of Fish and Game has proposed a project for statewide sage grouse conservation. This project is intended to benefit sage grouse and will not contribute to adverse cumulative effects.

3.1.2.7 Alternative 3 - Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

The rationale for development of stipulations for the preservation and maintenance of biological diversity was to reduce risks of adverse effects to biological resources. Therefore, NSO areas were increased or, where surface occupancy was permitted, TL and/or buffer zones were expanded to more closely approach maximum recommended levels found in published research literature. Table 3.1-8 compares the wildlife stipulations by alternative for raptors and grouse.

Table 3.1-8. Comparison of Raptor and Grouse Stipulations by Alternative

Species/Habitat Type	Alternative 1 Existing Lease Stips	Alternative 2 Forest Plan Stipulations	Alternative 3 Add'l Stips	Effect
Golden eagle active nest	TL: 1,320 ft. (1/4 mi.)	NSO: 1,320 ft. (1/4 mi.)	NSO: 2,640 ft. (1/2 mi.)	Increase in acres from 126 to 502
Prairie falcon	TL: 1,320 ft. (1/4 mi.)	NSO: 1,320 ft. (1/4 mi.)	NSO: 2,640 ft. (1/2 mi.)	Increase in acres from 126 to 502
Merlin “ “	TL: 1,320 ft. (1/4 mi.)	NSO: 1,320 ft. (1/4 mi.)	No change	None
Goshawk “ “	TL: 1,320 ft. (1/4 mi.)	NSO: 1,320 ft. (1/4 mi.)	No change	None
Prairie grouse lek	TL: 500 ft. from active lek	NSO: 200 ft. TL: 1,320 ft. (1/4 mi.)	NSO: 1,320 ft. (1/4 mi.) TL=10,560 ft. (2 mi.)	NSO: Increase in acres from 3 to 126 TL: Increase in acres from 126 to 8,038

Table 3.1-9 is a summary of the habitat by land cover that would be disturbed under the Alternative 3 leasing scenario. Figures 2.25 through 2.42, in the accompanying map packet, show the stipulations that apply for Alternative 3 and show the locations of the projected RFD

Table 3.1-9. Alternative 3: Summary of Land Cover Affected

A. Acres of Vegetation Cover by Land Unit

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills		22		7,722	161	137	1,941	130	292	776		2,022	132	9	1,077	14,420
S Cave Hills	3			5,021	0	2	1,144	88	466	160		1,152			327	8,364
Slim Buttes	5	4,962	11	19,370	27	1,670	4,578	172	667	574	3,733	2,843	1,316		3,648	43,574
W Short Pines		25		283	0		86	4	112	536					20	1,065
E Short Pines	37			2,621	0	10	1,198	8	618	1,088		308			186	6,074
Total	46	5,009	11	35,017	188	1,819	8,946	401	2,155	3,134	3,733	6,325	1,448	9	5,257	73,497
Percent	0.1%	6.8%	0.0%	47.6%	0.3%	2.5%	12.2%	0.5%	2.9%	4.3%	5.1%	8.6%	2.0%	0.0%	7.2%	100.0%

B. Acres of Vegetation Affected by Wells and Roads (Existing and RFD)

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills				9.7			0.1	0.8		0.5		0.1				11.1
S Cave Hills				21.9								0.4			0.2	22.6
Slim Buttes																0.0
W Short Pines				5.0					0.0	1.3						6.4
E Short Pines				3.3												3.3
Total				39.9			0.1	0.8	0.0	1.8		0.6			0.2	43.5

C. Percentage of Vegetation Affected

Vegetation Cover	Aspen	Badlands	Cotton-Wood	Grass-land	Not classified	Post Pole	Rimrock	Riparian	Saw Log <40% Crown Cover	Saw Log >40% Crown Cover	Seeding Sapling	Sparse Grass-land	Special Uses	Water	Woody Draw	Total
N Cave Hills				0.12%			0.01%	0.63%		0.06%		0.01%				0.08%
S Cave Hills				0.44%								0.04%			0.07%	0.27%
Slim Buttes																
W Short Pines				1.78%					0.04%	0.25%						
E Short Pines				0.13%												
Total				0.11%			0.00%	0.20%	0.00%	0.06%		0.01%			0.00%	0.06%

wells and roads. The Alternative 3 stipulations are listed in Chapter 2. Table 3.1-10 shows the acres of associated landform type disturbed under Alternative 3 for Forest Service Sensitive and Forest Service Indicator Species.

Table 3.1-10. Projected Effects of Alternative 3 on FS Sensitive and FS Indicator Species Habitat

Species	Land Cover Type	Habitat Acres Affected by Project Unit					Comments
		North Cave Hills	South Cave Hills	Slim Buttes	West Short Pines	East Short Pines	
Whitetail deer	Riparian, Woody Draws, Seedlings, Post/pole	0.8	0.2	0.0	0.0	0.0	Exceptionally adaptable to human activity. Riparian areas are under a CSU stipulation and Woody Draws are under an NSO stipulation.
Northern oriole	Riparian	0.8	0.0	0.0	0.0	0.0	MA M provides for CSU in riparian habitats
Yellow warbler	Riparian	0.8	0.0	0.0	0.0	0.0	MA M provides for CSU in riparian habitats
Northern leopard frog	Riparian, Water	0.8	0.0	0.0	0.0	0.0	MA M provides for CSU in riparian habitats
Ovenbird	Woody Draws	0.0	.2	0.0	0.0	0.0	Woody Draws are under an NSO stipulation.
Rufous-sided towhee	Woody Draws	0.0	.2	0.0	0.0	0.0	Woody Draws are under an NSO stipulation.
Loggerhead shrike	Woody Draws, Sparse Grassland, Grassland	9.8	22.5	0.0	5.0	3.3	Woody Draws are under an NSO stipulation. Surveys and mitigation would be required in grasslands under SLTs.
Burrowing owl	Sparse Grassland	0.1	0.4	0.0	0.0	0.0	Surveys and mitigation would be required in grasslands under SLTs.
Baird's sparrow	Sparse Grassland, Grassland	9.8	22.3	0.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Sharptail grouse	Sparse Grassland, Grassland	9.8	22.3	0.0	5.0	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Sprague's pipit	Grassland	9.7	21.9	0.0	5	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Lark sparrow	Grassland	9.7	21.9	0.0	5	3.3	Surveys and mitigation would be required in grasslands under SLTs.
Brewer's sparrow	Grassland	9.7	21.9	0.0	5	3.3	Surveys and mitigation would be required in grasslands under SLTs.

Table 3.1-10. Projected Effects of Alternative 3 on FS Sensitive and FS Indicator Species Habitat (Cont'd)

Species	Land Cover Type	Habitat Acres Affected by Project Unit					Comments
		North Cave Hills	South Cave Hills	Slim Buttes	West Short Pines	East Short Pines	
Northern goshawk	Sawlog >40% Crown	0.5	0.0	0.0	1.3	0.0	Mature coniferous forests are protected by a CSU stipulation. A TL applies to potential nest stands from 3/1 to 9/30 annually.
Ruffed grouse	Aspen	0.0	0.0	0.0	0.0	0.0	Aspen are protected by a CSU stipulation.
Townsend's big-eared bat	Rimrock	0.1	0.0	0.0	0.0	0.0	Potential habitat only in MA C where NSO applies.
Largemouth bass	Water	0.0	0.0	0.0	0.0	0.0	MA M provides for CSU stipulation in riparian habitats.
Smooth goosefoot	Riparian, Sparse Grassland	0.8	0.4	0.0	0.0	0.0	MA M provides for CSU stipulation in riparian habitats.
Northern gentian	Riparian, Grassland	0.8	21.9	0.0	5.0	3.3	MA M provides for CSU stipulation in riparian habitats.
Mountain bluebells	Riparian, Woody Draws	0.8	0.2	0.0	0.0	0.0	MA M provides for CSU stipulation in riparian habitats.
Douglas' dusty maiden	Sparse Grassland, Badlands	0.1	0.4	0.0	0.0	0.0	Surveys would be required under and lessees would be required to mitigate impacts under SLTs.
Dakota buckwheat	Badlands	0.0	0.0	0.0	0.0	0.0	Surveys would be required under and lessees would be required to mitigate impacts under SLTs.

Under the Alternative 3 scenario, RFD-projected new roads and well sites have been either eliminated or relocated, as necessary, to avoid sensitive resources protected by NSO stipulations. Both the North Cave Hills and the Slim buttes Land Units are placed under the protection of NSO stipulations for cultural resource concerns in this alternative. Two RFD-projected wells in Slim Buttes are eliminated and the other two wells are assumed relocated to non-Forest lands. Seven RFD wells in North Cave Hills were eliminated and the other five RFD projected wells are assumed relocated to non-Forest lands.

There is general belief that reduction in human noise and activity in the vicinity of wildlife activity areas, especially those of highest sensitivity, such as reproduction, roosting/hiding, and foraging, decreases human-induced stress. Several sources provide recommended buffer zones for protecting nest sites of raptorial birds and prairie grouse; however, these recommendations vary considerably. As an example, recommended buffers for golden eagle vary from 300 m (0.18 mi.) (Holmes et al. 1993) to 1 km (0.6 mi.) (Suter and Jones 1981).

Blumstein et al. (2002) indicated that reaction to human disturbance was species-specific, although species appeared to be idiosyncratic in their reaction to human disturbance. Therefore, they recommended that buffer zones should be developed using conservative estimates of habituation until site-specific data is developed. Using this strategy, buffer zones for species known to be sensitive to human activity have been increased in Alternative 3.

In addition, most of the studies on effects of human noise and activity disturbance have been focused flight initiation distance (FID). Temporarily vacating a nest site may, in itself, have little effect on nest success; however, in areas supporting egg/fledgling predators (primarily Corvids), this may result in nest failure (Snyder et al. 1986, Vander Hagen et al. 2002). NSO buffer zones surrounding nests of eagles and prairie falcons have been increased from ¼ mile to ½ mile, and the TL has been increased in duration. These increases are based on the same rationale developed for changing Custer Forest Plan standards as a result of the Southern Little Missouri Oil and Gas Leasing EIS (USFS 1996).

Prairie grouse NSO and TL areas surrounding “active leks” (see definition in glossary) have been appreciably increased to provide additional protection from disturbance. NSO surrounding active leks has been increased from 200 feet to ¼ mile (1,320 feet) and TL zones increased from ¼ mile to 2 miles. As with the eagle and prairie falcon stipulations, these increases are based on accepted rationale developed for changing Custer Forest Plan standards (USFS 1996).

North Cave Hills

Management Area E (Minerals Management) predominates in this unit, with Management Areas C (Rimrock), N (Woody Draws), and M (Riparian) covering the remainder. MAs C and N are protected by NSO stipulations. Oil and gas development over the entire unit is protected by NSO stipulations for other resource values. In addition, NSO stipulations for raptor nest buffers, prairie grouse leks, and wildlife habitat components can be applied as well. Exploration

activities that are exempt from NSO will have TL stipulations surrounding specific biological resources. TL stipulations will also be applied to specific biological resources.

The no lease (NL) and NSO stipulation that covers all of North Cave Hills has the effect of eliminating or relocating well sites off-Forest. The five wells projected to be located off-Forest will most likely be in the grasslands as they predominate off of the mesas. As a result, the grassland associates species would have their habitat disturbed. However, five wells would only be expected to disturb approximately 29 acres.

South Cave Hills

Management of this unit is predominately under Management Area B (Range) with considerable areas of Management Area C (Rimrock) and Management Area M (Riparian). The area contains 10 RFD-projected well sites. Of these 10, one is eliminated due to NSO stipulations, three are in locations that avoid NSO stipulations, three are assumed to be located off-Forest, and the remaining three are relocated on-Forest to non-NSO areas. No projected wells are located on NFS lands in areas requiring NSO or TL limitations. Buffers surrounding biological resources (raptor nest sites) result in NSO stipulations over much of South Cave Hills land cover as shown in Figure 2.26 in the accompanying map packet. The Alternative 3 biological stipulations are

shown in Figure 2.36 in the accompanying map packet. As a result, the projected well sites on-forest would avoid any adverse biological consequences. The three wells assumed to be located off-Forest would likely be within grasslands and would disturb approximately 17 acres.

Slim Buttes

Management Area B (Range) dominates this unit. In addition, Management Area C covers all rimrock areas, and a small area of Management Area D (Wildlife) occurs near the north end. The unit also contains a number of drainages with Management Area M (Riparian) and Management Area N (Woody Draws) designation. Oil and gas development over the entire unit is protected by NSO stipulations for other resource values. In addition, NSO stipulations for raptor nest buffers, prairie grouse leks, and wildlife habitat components can be applied as well. Exploration activities that are exempt from NSO will have TL stipulations surrounding specific biological resources. TL stipulations will also be applied to specific biological resources. Two of the four RFD wells projected for Slim Buttes are eliminated due to NSO stipulations. Both of the other two wells are assumed located on non-Forest lands and are projected to be dry gas wells. As a result, there would be a short-term disturbance of approximately 11 acres while the wells were drilled. Since these two wells are projected to be dry, the roads and pads would be rehabilitated after the drilling.

West Short Pines

The predominant management strategy for this unit is Management Area D (Wildlife) with areas of Management Area C (Rimrock) and Management Area M (Riparian). As can be seen on the Alternative 3 Composite Stipulation Map, Figure 2.29 in the accompanying map packet, the RFD-projected road and two gas wells (one dry) wells have been located in areas needing only standard lease terms. The two projected well sites are both within Management Area D (Wildlife) where CSU restrictions could be applied to protect wildlife concerns if necessary. Buffers surround raptor nest sites and result in both NSO (development) and TL (exploration). Goshawk habitat has been identified over approximately half of this unit and is protected by TL during the nesting period. The underlying Alternative 3 biological stipulations are shown in Figure 2.39 in the accompanying map packet. Both projected RFD well sites have been moved to areas where any impacts can be mitigated with only the BLM SLTs. Both projected wells and roads are predominately within the grassland land cover type (5.0 acres or 1.8 percent). One well extends slightly (1.3 acres or 0.25 percent) into the ponderosa pine with crown closure greater than 40 percent land cover type. However, this area is also protected by TL limitations for goshawk.

East Short Pines

The predominant management strategy for this unit is Management Area D (Wildlife) with areas of Management Area C (Rimrock requiring NSO). No surface occupancy stipulations protect much of East Short Pines land cover as shown in Figure 2.29 in the accompanying map packet. The underlying Alternative 3 biological stipulations are shown in Figure 2.39 in the accompanying map packet. Two small drainages on the west side are within Management Area M (Riparian requiring CSU). Mature forest stands on the west are potential goshawk nesting habitat and are protected by TL stipulations. The single projected well site is within

Management Area D (Wildlife), where CSU restrictions could be applied at the APD level to protect wildlife concerns if deemed necessary by the Forest Service after required site-specific investigations of actual planned well sites. The one well and road projected would impact 3.3 acres or 0.13 percent of the grasslands in the land unit. The population of smooth goosefoot in East Short Pines will not be affected by the proposed well site.

Direct Effects and Indirect Effects

Given the limited current and projected future oil and gas activity in the land units, effects of this alternative on biodiversity are expected to be negligible. The proposed Deer Draw RNA and rimrock are all protected by NSO stipulations. Riparian areas are protected by CSU stipulations. TL and NSO stipulations further protect raptors from impacts. Forty acres or 93 percent of projected disturbed area is in the grassland land cover type. As shown in Table 3.1-8, the 40.5 acres of grassland/sparse grassland represents one-tenth of one percent of the total grasslands in the five land units. Other landform types that are disturbed include ponderosa pine with crown closure greater than 40 percent (1.8 acres or 0.06 percent). The only impact to riparian areas is from an existing well. As a result, primarily only grassland-associated species would potentially be affected. Given the very small percent of the grassland affected and the amount of grassland in the land units and surrounding areas, the impact is expected to be negligible.

Vehicular activity on existing roads as a result of maintenance and potential additional development activities may expose individuals of species of concern to direct mortality by collision. However, such effects, while not quantifiable, are expected to be inconsequential given the limited amount of development reasonably foreseeable and the small amount of resultant traffic. Raptors have apparently become habituated to existing activities, some even having nested successfully within the projected timing limit distances of existing wells. Additional potential occurrences could lead to isolated instances of an individual's death; however, given the scope of the project and the activities involved, these are believed to be negligible.

Potential effects to sensitive plant populations in the East Short Pines and Slim Buttes units are negligible, as these populations can be identified in surveys and avoided under SLTs.

Cumulative Effects

As can be seen by Table 3.1-8, for the most part, only the grassland and riparian land cover types are projected to be affected. The only impact to the riparian area is from an existing well, and there is no documentation of substantial impact to wildlife from the existing wells over the past 20 plus years. As a result, the only additional habitat impact for Alternative 3 is essentially 40.5 acres of grassland, which represents less than one-tenth of percent of the grasslands in the five land units. Given this very small amount of grassland habitat disturbance coupled with the limited amount of other reasonably foreseeable projects identified and the vast amount of grasslands surrounding the five land units, it is not expected to result in cumulative impacts that would jeopardize any of the species of concern.

The State of South Dakota Department of Fish and Game has proposed a project for statewide sage grouse conservation. This project is intended to benefit sage grouse and will not contribute to adverse cumulative effects.

Summary

The application of the wildlife stipulations across the entire area in Alternative 3 rather than just in certain MAs as in Alternative 2 offers greater protection for maintaining natural biodiversity. When taken collectively with adjacent areas under all land ownership, both public and private, the effects of any of the alternatives are minor. The difference in projected effects between Alternative 2 and 3 is small due to the little amount of activity projected and the effectiveness of the stipulations. As demonstrated by the analysis of the RFD projections, the stipulations called for in all alternative leasing scenarios are adequate to protect the biological resources from any substantial adverse effects. The Alternative 3 stipulations reduce the risk of adverse effects, compared to Alternative 2, associated with the lack of consensus in the scientific community regarding adequate buffer distances for raptors.

3.2 ISSUE 2: CULTURAL RESOURCES

Cultural resources are objects, structures, sites, and districts that are considered important to an understanding and appreciation of the history and archaeology of the nation. Cultural resources are nonrenewable in the sense that physical manifestations of cultural acts, once such acts become part of the past, are no longer being created. Instead, those physical manifestations are in a steady state of decline from geological processes as well as continued human use of the landscape. Conservation of archaeological and historic properties and information for research, public interpretation, and use by future generations are emphasized by cultural resources management (USFS 1987, p. 4). Conservation and protection of cultural resources on federal lands or permitted by federal agencies are addressed by a series of laws and regulations beginning with the Antiquities Act of 1906. The laws, regulations and executive orders that address cultural resources of Forest Service land or permitted by the Forest Service are the National Historic Preservation Act (NHPA), Archaeological Resource Protection Act (ARPA), American Indian Religious Freedom Act (AIRFA), Native American Graves Protection and Repatriation Act (NAGPRA), 36 CFR 60, and 36 CFR 79. The Forest Service will comply with these laws and implementing regulations within the scope of this EIS. This section of the DEIS addresses primarily archaeological sites, and historic objects and structures rather than traditional cultural properties (TCPs) and culturally sensitive sites. Culturally sensitive sites and TCPs, which are addressed in Section 3.3, often consist of or include archaeological sites, so there is a degree of overlap between the two resource issues.

3.2.1 AFFECTED ENVIRONMENT

This section is excerpted from more detailed information provided in the technical report entitled *Archaeology of the Cave Hills, Slim Buttes, and Short Pines* (on file at the Custer National Forest Supervisor's Office). Much of the information on the post-settlement period is derived from the initial draft of this section provided by the Sioux Ranger District (LaPoint and Floodman 1997).

3.2.1.1 General Description of Sioux Ranger District Historic and Archaeological Resources

The Sioux Ranger District has been inhabited by multiple ethnic groups, beginning at least as early as 13,000 years ago (11,000 radiocarbon years before present [BP]), who have left an extensive array of archaeological sites. What may have attracted people to these isolated islands of rock and pine woodland in the rolling prairies was the diversity of scarce resources that they offered. Five ecozones in the elevated oases offered shelter, water, and forage for elk, deer, bison, bighorn sheep, wolves, bear, and mountain lions. Although the entire project area has not yet been intensively surveyed for archaeological sites, at least one area, the North Cave Hills, is considered to have the highest archaeological site density in the Northwestern Great Plains. The majority of sites represent the last one to two thousand years of American Indian occupancy, but archaeologists have discovered evidence of a number of earlier occupations as well as sites representing the early period of settlement by non-Indians.

3.2.1.2 Human Prehistory and History of the Project Area

Throughout most of the prehistoric period, which spans the time from around 13,000 years ago until the early nineteenth century, the basic pattern indicated by archaeological material in the Sioux Ranger District is typical of the Northwestern Plains. The area was occupied by hunting-based cultures that used a wide variety of resources, but depended heavily on bison. They lived in temporary camps and moved seasonally from one food and raw material gathering area to another. Even during the last few hundred years of prehistory, when the area was occupied seasonally by farmers from the middle reaches of the Missouri River, its main attraction was the abundant supply of bison, pronghorn, and other large game.

Human prehistory in the Northwestern Plains begins with the Paleoindian period, dated at 11,500 to 8000 radiocarbon years before present (rcybp). The earliest Paleoindian period includes the Clovis and Goshen complexes, which were left by hunters of mammoth, bison *antiquus*, and other late Pleistocene animals. By 10,500 rcybp, when the subsequent Folsom complex had become widespread, the mammoth was extinct, and people focused their attention on bison. These three complexes are assumed to represent small, nomadic groups, with highly developed chipped-stone tool technologies, but few sites other than animal kills sites have yet been excavated in the Northern Great Plains. The later Paleoindian period includes a large number of complexes, defined largely on projectile point types. All of these continue to represent nomadic bison hunting groups, but by the end of the period more specialized adaptations had emerged, including seasonal occupation of high altitude areas and use of a wide variety of plants and animals. No extensive Paleoindian sites have been identified in the project area, although isolated discoveries of late Paleoindian projectile points show that the area was occupied for at least the last 10,000 years (Beckes and Keyser 1983; Metcalf and Black 1985).

The trend towards regional diversity continued throughout the subsequent Archaic period, which dates from 8000 to 1500 rcybp. The Early Archaic (8000-5500 rcybp) marks the transition from the relatively moist and mild climate of the terminal Pleistocene to the much drier and more extreme climate of the Holocene. Bison were evolving into a smaller form and pronghorn were thriving in the dry western basin and range country. All Northwestern Plains groups still relied heavily on hunting, but were increasingly developing seasonal migration patterns and technologies that allowed them to use a greater diversity of resources. Sites dating to this period are rare, due at least in part to the instability of the land surface during this dry time. There is little evidence of Early Archaic occupation in the project area. Large side-notched projectile points probably made during this period have been found at Ludlow Cave (Metcalf and Black 1985) and an as-yet-undated occupation layer at 39HN221 in Davis Draw (Beckes and Keyser 1983), but in neither case is it likely that the artifacts are in their original locations. Early Archaic sites have, however, been found outside Sioux Ranger District boundaries, east of the Cave hills, confirming habitation during this period (Gant 1961; Fosha 2001).

By the Middle Archaic period (5500-2500 rcybp), local groups appear to have been following seasonal rounds throughout well-defined territories. These groups had developed effective technologies for storing meat and plant foods, which probably allowed them to winter over in pit houses, at least during severe weather (Larson 1997). Middle Archaic sites are abundant in the Northwestern Plains and include periodically reused campsites, kill sites, and several localized

kinds of burial sites. During this period, the Northwestern Plains climate returned to moister conditions and sedimentation increased. The erosional forces that appear to have removed much of the Early Archaic record lessened or stopped, and the Middle Archaic record is well preserved throughout most of the area. It is represented in the project area at the Lightning Spring Site (39HN204) (Keyser 1985; Wettstaed et al. 1991), and at seven other localities.

The Late Archaic period (2500-1500 rcybp) saw the development of several new cultures in the Northwestern Plains. At first, the Pelican Lake Complex and other, unnamed complexes held sway. Later in the period, the Besant Complex appeared. This was a bison-hunting based culture that may have derived from Eastern Woodland groups who had migrated up Plains rivers during what is known there as the Woodland Period. These immigrants may have initiated the long-standing pattern of eastern Missouri River-based tribes traveling west in summer and fall to hunt and obtain resources such as tool stones and eagle feathers. The first secure evidence for use of tepees in the Northwestern Plains comes from the Late Archaic period and coincides with a renewed emphasis on bison hunting. That change coincided with continued moist, mild conditions that permitted bison populations to increase. Late Archaic assemblages are known from 11 sites in the Project Area, representing both the Pelican Lake and Besant complexes. They include tepee rings and a bison drive in addition to small campsites similar to those of the Middle Archaic.

The Late Prehistoric period saw the introduction of the bow-and-arrow in the Northwestern Plains, beginning about 1500 radiocarbon years ago. Nomadic bison hunting appears to have been the rule during this period, with groups living in small, dispersed tepee camps throughout most of the year and gathering into large interband encampments in summer for trade and ceremonies. In the Middle Missouri region, which after 1200 AD had become inhabited by farmers expanding outward from the middle Mississippi and lower Missouri rivers, groups alternated between large earthlodge villages in the summer months and small tepee camps in sheltered locations in winter. For part of the summer and fall, hunting parties would travel far to the west, into the project area, in search of bison and other resources, while other members of the group remained behind at the village to tend the cornfields. These groups from the Middle Missouri, who were part of the Plains Village Complex, added ceramics to what had previously been archaeological tool kits consisting only of stone and bone implements.

The Late Prehistoric period is well represented in the project area, accounting for most of the known archaeological sites. Ludlow Cave (39HN1) and two nearby rockshelters, Pelham's Cave (39HN5) and 39HN24, contained evidence of Late Prehistoric and Plains Village use of the area. These sites contained ceramics from three different Middle Missouri complexes: Initial Middle Missouri and two Post-Contact Coalescent phases (Alex 1979; Wood 1971; Wood and Downer 1977) that may indicate proto-Mandan, proto-Hidatsa, and proto-Crow use of the area, respectively. The Mandan and Hidatsa lived in semi-sedentary villages along the Missouri River in the Dakotas, but they traveled westward seasonally to hunt bison and trap eagles. The Crow tribe of historic times formed from bands that splintered off from the Hidatsas over a period of about 500 years, ultimately settling far to the west of the Missouri in eastern and central Montana. Other sites include campsites, eagle trapping pits, tepee rings, and smaller stone circles and cairns that may be vision quest monuments. Rock art is also abundant, particularly in the North Cave Hills. High rates of erosion of the weak sandstones on which it is rendered and

stylistic connections to larger regional rock art traditions place the Cave Hills rock art within the last 2000 years, and most within the last 500 years (Sundstrom 1993; Keyser 1984, 1987a,b). Offerings left at the Ludlow Cave site, beginning during the early Plains Village period, are evidence that this locality of the North Cave Hills was already a place of religious importance.

During the latest prehistoric and early historic periods, the ethnic makeup of the project area underwent a series of changes. Between the early fifteenth and late eighteenth centuries AD, the project area was controlled sequentially or coincidentally by the Mandan, Hidatsa, Crow, Kiowa Apache, Eastern Shoshone, Arapaho, Cheyenne, Arikara, and Lakota (see more in depth discussion under “Traditional Cultural Properties”). The last three of these groups entered the area in the late eighteenth century, after the introduction of the horse. Farming peoples from the upper Midwest, they had abandoned their villages for nomadic, equestrian bison hunting. By the mid-nineteenth century, the area was dominated by the Lakotas, but was still used by many of the other groups. The Hidatsa and Mandan, in particular, visited the area seasonally from their Missouri River villages for hunting and eagle trapping. By this time, non-Indians had also begun moving through the Great Plains along the emigrant trails and were starting to encroach on lands claimed by the American Indian tribes. Wars resulted from these episodes of ethnic expansion, some between American Indian tribes, and others between alliances of tribes and the EuroAmericans. Archaeological manifestations of these protohistoric and early historic periods in the Project Area include four sites containing trade items along with American Indian-made artifacts and rock art sites depicting horses and guns. An eagle trapping lodge located in the Slim Buttes attests to the Mandan/Hidatsa use of that area.

Conflict between Euroamerican Settlers and local tribes led to a series of treaties, including the 1868 Treaty of Fort Laramie that established the Great Sioux Reservation in the western part of what had become designated the western Dakota Territories. The treaty did not stabilize relations, as rumors of gold in the Black Hills led to public agitation for the U.S. Government to open this area to exploration and settlement. This led to the first documented EuroAmerican exploration into the project area--a visit to Ludlow Cave by Colonel George A. Custer, while en route to the Black Hills to determine if it was feasible to locate a military post there and whether the reports of gold deposits were true (O'Harra 1929). True they were, and an ensuing gold rush into the Black Hills again destabilized American Indian-White relations.

Despite a string of military victories by the Lakota and Cheyenne, the loss of the buffalo to climatic deterioration, over-predation, and the Euroamerican hide trade, coupled with the influx of non-Indian gold seekers, soon left the Plains tribes destitute and starving. One conflict that took place during this period of collapse was the Battle of Slim Buttes. A cavalry contingent under General Crook, chasing bands that had taken part in the Battle of Little Bighorn, fell upon a group of Lakota under American Horse, killing him and many members of his band before being driven off by Crazy Horse. By 1877, the Great Sioux Reservation was broken into smaller parcels and most of it, including what is now the South Dakota portion of the Sioux District, opened to white settlement (Hyde 1937, 1961; Kingsbury 1915; Schell 1975).

Settlers flooded into the Black Hills country. Since the Bismarck-Deadwood stage route ran near Cave Hills and Slim Buttes, a few isolated settlements were established in the vicinity. Wickamville was one of the first towns established along the Little Missouri River in 1879. In

1883, a post office was established there and the name was changed to Camp Crook in honor of General George Crook. E.P. Whitcomb established one of the first sawmills in the area in 1884 in the west Short Pine Hills. Later, another sawmill was brought in by DeBelloy and Turbiville (Clark 1982; Odell 1983).

Although the project area had been open for non-Indian settlement since 1877, most of it remained open range for a decade. Large cattle companies brought in Texas cattle; other outfits ran sheep. Among these large operations were the Roosevelt Ranch based in the North Cave Hills, Abe Jones in the Slim Buttes, J. Grant in the Short Pine Hills, and the Empire Sheep Company near Buffalo (Hanson 1933). By 1884, some 700,000 to 800,000 cattle grazed these ranges (Brooks and Jacon 1994), but severe winters in the late 1880s killed many thousands. By 1890, open-range cattle droving ended, but large cattle outfits continued to operate ranches in the area (Lee and Williams 1964). The area that would become Custer National Forest remained largely unsettled.

Harsh weather and competition with the big cattle companies defeated many homesteaders. One of the early victims was Mrs. Otis Tye who lived in a dugout in the Slim Buttes. During a severe blizzard in the winter of 1888, Mrs. Tye froze to death while searching for a team of horses and was buried near their dugout (Burns 1969; Aicher 1982). Her grave and dugout are located on Forest Service land.

In 1890, some Lakotas on the Pine Ridge Reservation began following the Ghost Dance Religion. This was based on the belief that, by performing rituals, American Indian tribes throughout the west could effect the removal of white settlers, reunite all American Indians with their deceased relatives, and return to their former ways of life (Mooney 1898; Utley 1993). Sitting Bull was suspected of being a major influence behind this new threat and the decision was made to arrest him (Mooney 1896). He was shot and killed while resisting arrest by Indian police (Fechet 1908; Utley 1993) and this started rumors that a group of angry warriors had left the reservation and were headed for the Cave Hills. Several residents of the Cave Hills gathered at the Lewis residence, near present day Harding, and constructed rifle pits and trenches in preparation for the Indian attack. Despite the panic, no conflicts arose in the project area. Instead, the Ghost Dance ended in tragedy at Wounded Knee, near Pine Ridge, where US soldiers killed nearly 200 Lakotas. US Army soldiers were stationed on the east side of Slim Buttes through the remainder of the winter. Their names can still be seen on the sandstone outcrops around J B Hill (Hanson 1933).

The Cave Hills, Short Pine Hills, and Slim Buttes Forest Reserves were established in 1904 and consolidated (with two units in eastern Montana) into the Sioux Forest Reserve in 1908 (Clark 1982). The Slim Buttes National Forest was established in 1906, and in 1913 the Jesse Elliot Ranger Station (39HN436) was established to administer grazing and timber in this area. The station included a stone dwelling, a sod barn, a bunkhouse, a chicken house, and a coal shed. The stone building was recommended as eligible for listing on the National Register of Historic Places, because it is one of only a few stone buildings constructed by the Forest Service in Region 1 (Bolton and Hubber 1990). The Custer and Sioux National Forests were consolidated in 1918 and the name changed to Custer National Forest in 1920 (Clark 1982).

As family ranches replaced the large outside cattle interests, towns like Buffalo and Camp Crook were established as market centers. The main period of town building in Harding County took place after 1910. Cattle and sheep ranching remain the principal industries in Harding County today, although oil and gas extraction are gaining importance.

Small-scale lignite coal mining was common in western South Dakota during the early 1900s, usually providing fuel for area homesteads. Three of the larger mines operating in Harding County were the Hodge near Reva, the Giannonatti near Ludlow, and the Hilton in South Cave Hills (Hanson 1933). The Hilton Mine (39HN534), has not been thoroughly investigated, but consists of the remains of the mine and building (Sundstrom 1993).

According to long-time residents of Harding County, American Indian families from the Standing Rock Reservation continued to visit the area throughout the first half of the twentieth century on hunting and berrying expeditions. Traditional offerings observed near Ludlow Cave in 2000 indicate that the area continues to hold religious significance for some American Indians.

During the 1930s, Civilian Conservation Corps (CCC) camps were established at Camp Crook and Plum Creek. The CCC organized massive forces of unemployed young men to work on a variety of forest- and range-related projects throughout the country (Baker et al. 1993; Malone and Roeder 1976). Camp DF-19, Company 2747, was located approximately 12 miles north of Camp Crook, and opened as a tent camp in July 1934. By October, 225 men were actively working on projects on National Forest lands, including construction of small reservoirs, spring development, fencing, road surfacing, surveying National Forest boundaries, building picnic areas, thinning timber, constructing a ranger station at Camp Crook, and exterminating prairie dogs (Alleger ca. 1935). One product of their efforts was the Picnic Springs Campground, which is still in use.

Large-scale mining exploration and development increased within the forest units of Harding County during the 1950-1960s. By mid-1955, nearly 65,000 acres within the Slim Buttes and Cave Hills contained mineral claims. From 1962-66, Kerr-McGee and other mining companies strip-mined uranium-bearing lignite deposits in the Slim Buttes and Cave Hills. The largest of the stripped zones is approximately 25 acres. Oil and gas drilling have taken place in the Cave Hills since 1972 and continue to the present day (Clark 1982).

Apart from the unreclaimed strip mines, post-contact use of the project area has resulted in relatively few changes to the environment. At 0.5 persons per square mile, Harding County has one of the lowest population densities in the US. A few roads have been constructed to provide access to oil wells, water wells, catch dams, and one natural gas well. The main use of the area historically, however, has been sheep and cattle ranching, which has had only minimal impacts.

3.2.1.3 General Type and Condition of Archaeological Properties

The abundance of natural resources at these mesas, including wood, water, tool making materials, game, and shelter, provided an ideal environment, drawing many people to these forested islands on the plains. Archaeological sites are abundant. At this writing, there are 531 known archaeological sites in the Project Area. These sites generally represent hunting and animal processing, temporary residence, toolstone gathering and working, eagle trapping, and

religious activities. Sites are categorized as rock art panels, artifact scatters, burials, bone beds, eagle trapping pits, toolstone procurement and tool manufacture, rock cairns, rock shelters, stone alignments, stone circles, vision quest locales, timber lodges, and historic sites.

Archaeological sites of the prehistoric and protohistoric periods are environmentally patterned. Stone circles (a.k.a tepee rings) and artifact scatters, which represent campsites and food processing areas, occur in valleys, on toe slopes, and on mesa tops. Bone beds occur in deep soils of draws, alluvial fans, and toe slopes. Vision quest markers, cairns, and eagle trapping pits occur on the rimrocks, while rock art is common in the overhangs below the rim and on other more resistant sandstone outcroppings. These four site types have been identified as culturally sensitive sites (Deaver and Kooistra-Manning 1995). Localities with deeper soils, including alluvial fans, valley floodplains, mesa tops, and rock overhangs often contain buried, deeply stratified sites that have the greatest scientific potential for both archaeological studies and paleoecological studies of plant microfossils. Cultural properties represent the full post-glacial period, but sites dating to the Late Archaic through to the Proto-Historic and Historic periods are by far the most common.

3.2.1.4 Status of Archaeological Inventories

Although the following paragraphs list numerous documented archaeological sites, the project area has not been systematically inventoried to a level that would fulfill requirements of Section 106 of the National Historic Preservation Act (NHPA). Most surveys have been conducted at reconnaissance level. The extent of archaeological surveys varies by area (Table 3.2-1). Although records obtained from the South Dakota Archaeological Research center do not precisely match those of the Custer National Forest, it is evident that only 10 to 14 percent of the Project Area has been surveyed for archaeological resources at any level. Less than one percent has been subjected to Section 106-level inventory. Many of the sites that have been documented have not yet been evaluated for eligibility to the National Register of Historic Places (NRHP).

Table 3.2-1. Estimated Survey Coverage of South Dakota Portion of the Sioux Ranger District, Custer National Forest, Based on Data from the South Dakota Archaeological Research Center^{a,b}

Unit	Area Covered by Block Surveys	Distance Covered by Linear Surveys	Total Unit Area	Percent Surveyed
North Cave Hills	3.08 square miles	1.82 miles	21.7 m ²	14%
South Cave Hills	1.80 square miles	3.61 miles	13.1 m ²	14%
Slim Buttes	1.26 square miles	9.54 miles	67 m ²	1.9%
East and West Short Pines	4.91 square miles	2.64 miles	11.2 m ²	44%
TOTAL	11.05 square miles	17.61 miles	113 m²	9.8%

^a Since the tabulation does not account for varying survey standards and techniques, these figures should be considered an estimate of the maximum area and percent surveyed.

^b Forest Service records provide a different set of numbers, but in neither case is the extent of survey greater than 15% of the total area.

To date, 44 sites have been listed on the National Register of Historic Places. Forth-three of these are rock art sites located in the North Cave Hills, nominated and listed as part of a

statewide rock art nomination. The remainder is the Lightning Springs Site, a prehistoric camp that is also located in the North Cave Hills

Numbers of known archaeological sites of various types and the NRHP eligibility status of these sites are listed in Tables 3.2-2 and 3.2-3.

Table 3.2-2. Archaeological Site Types Found in the Project Area, by Unit

Unit Name	SITE TYPES												
	RS	RC	RA	SA	AS	SC	VQ	B	BB	TL	QW	MH	EP
North Cave Hills	27	19	99	2	96	83	3		1		4	16	1
South Cave Hills	3	7	3		5	6	1	1				5	1
East and West Short Pines		15		1	73	8					6	17	2
Slim Buttes		9			55		1			1		4	2

AS= artifact scatter; EP=eagle trapping pit; MH=miscellaneous historic; QW= quarry/lithic workshop; RA=rock art; RC=rock cairn; RS=rockshelter; SC= stone circle; SA= stone alignment; VQ= vision quest; B=burial; BB=bone bed; TL=timber lodge.

Table 3.2-3. NRHP Eligibility Status of Archaeological Sites

Unit Name	NUMBER OF SITES				
	TOTAL	L	E	N	U
North Cave Hills	323	44	130	10	139
South Cave Hills	25	0	6	6	13
East and West Short Pines	115	0	16	13	86
Slim Buttes	69	0	22	4	43

L=listed on NRHP; E=eligible, not listed; N= not eligible; U=eligibility undetermined.

Since archaeological inventories are far from complete, it is not possible to be precise about the impacts oil and gas leasing would have on this resource category.

3.2.1.5 North Cave Hills

The North Cave Hills is suspected to have the highest density of archaeological sites in the northern Great Plains. To date, 323 sites have been recorded (Table 3.2-3). Primarily, they represent prehistoric occupations; fewer than five percent represent historic activities. Most are categorized as artifact scatters, but rock art and stone circle sites are also prominent. The majority of these sites are located in the upland areas including butte tops and along the rimrocks; very few have been identified within the valley floodplains. Archaeological assessments in the North Cave Hills unit have identified 174 sites that are either listed on or are eligible for the NRHP, although an almost equal number have not yet been formally evaluated.

Most of the NRHP-listed sites are located in the southeastern half of the unit, in an area proposed as the Ludlow Cave Archaeological District. The district was proposed for nomination because of its significance to archaeology, traditional cultural practices, and association with the 1874 Black Hills Expedition. Altogether, the district contains 212 recorded archaeological sites, of which 142 are identified as contributing to district significance.

The most important and intensively studied archaeological sites within this unit are Ludlow Cave, Lightning Spring, and the Mossbacher sites. The historic sites in the North Hills unit are associated with the following events: Custer's 1874 Black Hills Expedition, early settlement, sheep herding and cattle ranching, 1930s Civilian Conservation Corps activities, and the establishment of the Custer National Forest in 1904.

Members of Custer's Black Hills Expedition first excavated Ludlow Cave in 1874, although it was not until 1920 that the first archaeological studies took place. The archaeological components that have been identified span several thousand years from the Early Archaic period to Custer's Black Hills Expedition. The diverse range of materials, including perishable items, ceramics, and tools representing several time periods, make Ludlow Cave an important archaeological resource. The Lightning Spring site (39HN204), and the Mossbacher sites (39HN152, 9HN157/158, 39HN163), all contain deeply stratified sediments from which numerous artifacts have been recovered that can be identified to specific cultural periods.

3.2.1.6 South Cave Hills

In the South Cave Hills unit, 25 sites have been recorded (Table 3.2-3). The majority of these sites were identified as rock cairns or stone circles (Table 3.2-2); another 20 percent of the sites are associated with historic period activities. The prehistoric sites tend to be located in the upland areas, while the historic activity areas are primarily identified in more low-lying mesa slopes and valley floodplains. Archaeological assessments in the South Cave Hills unit have not identified any sites that have been listed on the National Register of Historic Places. Although six of the sites have been assessed as eligible, almost half of the known sites have not been formally evaluated.

The South Cave Hills unit contains the only identified, possible burial in the project area (39HN529). Rock art depicting images of bison heads was identified below this site on a rock outcrop. The artifacts that have been recovered from sites in the South Cave Hills provide little information in respect to their cultural association. Historic sites in this unit include the Hilton mine--a small family operated coal mine--and several rock outcrops that have been inscribed with the names of early settlers.

3.2.1.7 Slim Buttes

In the Slim Buttes unit, 69 sites have been recorded (Table 3.2-3). Approximately 80 percent of these sites have been assessed as artifact scatters, 10 percent are rock cairns, and 6 percent of these sites represent historic activities (Table 3.2-2). Although two-thirds of the sites have not been formally evaluated, at least one-third of the total number of sites are eligible for listing on the National Register of Historic Places

Two archaeological sites in this unit have been studied intensively. These are the Slim Buttes timber lodge and the Summit Springs site. The most unique site is 39HN201, a timber lodge that was most likely made by Hidatsa eagle trappers. Anthropologist George Will first identified this site in 1908. He described the lodge as a 10-foot-wide circular structure constructed with aspen logs that were covered with straw and mud. The lodge has been repaired several times in the last hundred years and is considered eligible for NRHP listing. The Summit Springs site (39HN569), located on the southern summit of the Slim Buttes, is an important archaeological resource in this unit. It is a deeply stratified campsite with an abundance of artifacts and cultural layers representing the Early Archaic period through the Late Prehistoric.

Historic sites in this unit consist of a dugout that was likely used as a shed or garage, the Jesse Elliot ranger station that was built in the early 1900s, and two artifact scatters. Although the ranger station may be eligible, it has not been formally evaluated. One of the sites includes an historic grave, that of Mrs. Otis Tye

3.2.1.8 East and West Short Pines

In the Short Pines unit, 115 sites have been recorded (Table 3.2-3). Sixty percent of these sites have been assessed as artifact scatters, fourteen percent are rock cairns, seven percent stone circles, two are eagle trapping pits, and another seven percent of these sites represent historic activities (Table 3.2-2). Only a quarter of the sites identified have been evaluated for listing on the National Register of Historic Places; 16 were found to be eligible.

The majority of the lithic quarries identified in the project area are located within this unit, as well as many of the artifact scatters. This suggests that this area was an important source of stone tool materials and may have played an important role in the seasonal movement of the Plains Indians. The ESP Quarry site (39HN298), attributed to the Plains Village period, has been the most intensively studied site in this unit. The 17 identified historic sites include inscriptions on sandstone, several “Johnny” cairns, and a farmstead.

3.2.2 ENVIRONMENTAL CONSEQUENCES

Oil and gas development entails a series of activities that have the potential to adversely affect cultural resources in the project area. These activities include surveys for seismic exploration lines; seismic exploration itself; surveys to establish drilling pads for oil wells, gas wells, injection wells, roadways, and pipelines; and maintenance of those facilities. In addition, minerals development can bring more visitors to an area, either as temporary work crews or as recreationists using newly constructed or improved roads. Impacts can be direct, indirect, or cumulative. Individual cultural resources on the Forest Service lands addressed in this DEIS can receive direct and indirect impacts, so these levels of impact are similar to the issues of effect that are addressed by Section 106 of the NHPA. Section 106 provides for findings of no adverse effect through mitigation, but mitigation means lessening of impacts to cultural resources, not that the cultural resources are not damaged by an undertaking. Even with data recovery, some data about a site, and the site itself, are lost. An undertaking can thus damage numerous cultural resources but still have no official adverse effect. If findings of no adverse effect can be achieved through compliance with Section 106 and a policy of avoidance or mitigation of adverse effects, all project alternatives can potentially be considered equivalent in their impact on

cultural resources. For that reason, the impact considered here is the potential to damage cultural resource sites, regardless of whether or not that damage will be mitigated.

Well pad, roadway, and pipeline construction are earth moving activities that have the potential to destroy or severely compromise the characteristics of significant cultural resource properties that render them eligible for the National Register. Seismic exploration can also cause destruction by driving over sites with vehicle tires or compacting soil and potentially crushing artifacts and animal bones with the vibrating pad. This damage is usually minor at first, but when tires break up the surface soil, they make it more prone to secondary impacts from erosion. Less obvious, potential direct impacts would be to rock art sites, and to stone alignments and structures. That impact would be from the vibration itself. Low frequency vibration might trigger sloughing of the loosely-consolidated sandstone that contains rock art images, speeding the process of exfoliation that has reduced many panels to near invisibility. Vibrations from heavy vehicles and seismic activities might also increase mass wasting of the cliff faces that contain rock art and cause precariously-placed stones in alignments and cairns to roll from position.

Surveying activities, new roads, operation of drilling rigs, and maintenance of proven wells, roads, and well-side facilities have indirect impacts because they bring new people into contact with archaeological sites. Amateur collectors among work crews and recreationists will encounter sites in this remote area and might be tempted to collect artifacts, either by surface collection or unsystematic excavation. Such collectors often deplete surface sites of the artifacts, such as projectile points and ceramics, which render a site scientifically meaningful and destroy stratigraphic relationships among artifact assemblages. Even non-collectors may make incidental discoveries of arrowheads or other artifacts and casually collect them as souvenirs. Finally, from Custer's Black Hills Expedition onward, people have been tempted to carve their names and initials into the soft caprock of the mesas. While some of these graffiti are now considered historical resources, new graffiti might inadvertently or intentionally be placed over near-invisible ancient rock art and would now be considered an adverse effect. More visitors to the project area can mean more graffiti and, potentially, increasing damage to rock art.

Although archaeological surveys of the project area are considered too incomplete for a predictive model if archaeological site probabilities to be devised, it is clear that sites are environmentally patterned. As noted in section 3.2.1.3, sites in general are more common in rimrocks (eagle trapping pits, cairns, rock art, stone circles, rockshelters), in the fine wind-blown soils of mesa tops (stratified campsites), along the base of mesa slopes (toolstone processing sites), and alluvial fans and valley bottoms (buried campsites and bone beds). Developments in such areas have a higher than average probability of affecting significant cultural resources.

In addressing the potential impact of proposed oil and gas development in the South Dakota portion of the Sioux Ranger District, the Forest Service is undertaking a phased compliance approach. This approach is designed to ensure that historic properties are not only considered at this early stage of planning (pursuant to 36 CFR 800.3 (c)), but also during development, when potential impacts to cultural resources are more readily definable. The second phase of compliance is clearly spelled out in the Forest Plan, which specifies steps that will be taken in

compliance with Section 106 of the NHPA when oil and gas development is contemplated. (Details of Forest Plan direction are described below in Section 3.2.2.1, Management Direction).

3.2.2.1 Alternative 1 - No Action, No New Leases

Management Direction

This alternative is governed by the stipulations in the existing leases that remain in the North and South Cave Hills. Stipulations for leases M54525 (west flank of South Cave Hills) and M54158 (center of the North Cave Hills) include the following language:

The federal surface management agency is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking surface disturbing activities on the lands covered by this lease the lessee or operator, unless notified by the authorized officer of the surface management agency shall:

- 1. Engage the services of a qualified cultural resources specialist acceptable to the Federal surface management agency to conduct an intensive inventory for evidence of cultural resource values.*
- 2. Submit a report acceptable to the (Forest Service) and the District Engineer, Geological survey.*
- 3. Implement mitigation measures required by the surface management agency to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator and materials salvaged will remain under the jurisdiction of the U.S. Government.*

The lessee is also required to immediately notify the Forest Service District Ranger if any cultural resources are encountered in the course of surface-disturbing activities and to leave such discoveries intact until directed to proceed by the District Engineer, Geological Survey.

These stipulations are referred to below as standard lease terms, and are designed to keep the Forest Service in compliance with the National Historic preservation Act (NHPA). Items 1 through 3 are covered under Section 106 of that act, which requires the Forest Service, as a federal agency, to take into account the effects of any federally licensed or permitted activity on historic properties and to give the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officer (SHPO) a reasonable opportunity to comment regarding the undertaking (36 CFR 800.1). That section does not require an agency to mitigate (or require the proponent to mitigate) the adverse effects of an undertaking. The Custer National Forest, however, in consultation with the SHPO and other consulting parties, including American Indian tribes), develops and evaluates alternatives or modifications to each undertaking to avoid, minimize, or mitigate adverse effects on historic properties.

Cultural resources are not addressed in stipulations for Lease M43521, which covers the north end of the North Cave Hills. However, since the lease dates to 1979, it is reasonable to assume

that NHPA Section 106 terms apply. When these leases expire, no new leases are contemplated and the area would be managed under the current Forest Plan.

Effects of this alternative will be those arising from oil and gas operations in existing lease areas.

North Cave Hills

RFD projections place two wells and their access roads in existing lease areas of this unit; both are situated on mesatop landforms. The areas for these suggested developments have not been subjected to archaeological surveys, so additional sites might also be affected. Construction of well pads and well drilling at these near-rimrock locations could adversely affect as-yet-undiscovered rock art and stone alignment or cairn sites through vibration. Indirect effects would result from bringing additional visitors to the central part of the cave hills, introducing them to many surface archaeological sites in areas surrounding their work site, and increasing the risk of casual artifact collection, graffiti on bedrock surfaces, and intentional looting.

Potential future development outside these projected well pads might occur in any areas where surface occupancy is permitted, which are primarily in valley bottoms and on mesa tops. Since the archaeological resources of the lease areas have not been thoroughly inventoried, it is not possible to quantify impacts to such properties at this time. However, it is reasonable to expect that exploration activity, road, and well-pad construction might damage archaeological sites directly through excavation and vibration effects, as well as indirectly by increasing artifact collection from sites in the explored and developed areas. This indirect impact could include any or all of the 44 listed NRHP properties in the proposed Ludlow Cave Archaeological District.

South Cave Hills

Projected access road and well sites within existing lease areas do not come within 600 feet of any documented archaeological sites. However, this unit has received little archaeological survey attention at any level, so it is possible that significant archaeological sites occur at or near well pad sites.

Potential future development outside these projected well pads might occur in any areas where surface occupancy is permitted, which are primarily on toe slopes and mesa tops. Since the archaeological resources of the lease areas have not been thoroughly inventoried, it is not possible to quantify impacts to such properties at this time. However, it is reasonable to expect that exploration activity, road, and well-pad construction might damage archaeological sites directly through excavation and vibration effects, as well as indirectly by increasing artifact collection from sites in the explored and developed areas.

Slim Buttes

No impact is expected because there are no existing leases in this area.

West Short Pines

No impact is expected because there are no existing leases in this area.

East Short Pines

No impact is expected because there are no existing leases in this area.

Cumulative Effects

The number of intact cultural resource sites in a region is constantly declining as a result of natural processes (erosion, deterioration) and a broad range of human activities. Road construction, farming, stock trampling, residential and commercial development, artifact collection, and vandalism all contribute to this decline. Unlike paleontological resources, which are buried in rock strata and become exposed and, therefore, known as a result of these processes, cultural sites occur only at or immediately below the ground surface. The project area is subject to some of these processes of decline, but by virtue of its protection under federal statutes, particularly ARPA and the NHPA, it can be expected to experience this loss at a slower rate than might be expected.

Consisting as it does of forested islands in a prairie sea, the project area contains a different range of cultural resource sites than the surrounding area. Eagle trapping sites, rock art, spirit vision and fasting locations, and rockshelter sites are more common in, if not exclusive to, these localities. Therefore, loss of or damage to these more unusual sites is a more substantial reduction in the cultural resource base than would be damage to an artifact scatter or tepee ring that might be repeated thousands of times throughout the northwestern Great Plains.

Future activities on the Sioux Ranger District are limited largely to fire control, continuation of grazing leases, extant oil and gas leases, uranium mine reclamation, and uses by the public for such activities as recreation, hunting, and bird watching. With the exception of uranium mine reclamation, fuel hazard abatement, and exploitation of extant leases, discussed above, these activities will have little direct impact on archaeological resources. Indirect impacts from artifact collection and vandalism will occur. Activities in the surrounding area include farming, stock raising, and oil and gas development on state and private lands. Cultural resources receive fewer protections on these lands, which means that the cultural resource base of the area steadily declines.

3.2.2.2 Alternative 2 - Proposed Action, Lease With Forest Plan Stipulations

Management Direction

This alternative is governed by the Forest Plan. The Forest Plan states in Chapter II, Section E, Part 8b, paragraphs 1-3 “Geophysical Operations” (USFS 1987, p. 27), that the forest will continue to manage cultural resources as directed by the National Historic Preservation Act (NHPA), the 1906 Antiquities Act, the Archaeological Resources Protection Act (ARPA), and other relevant federal regulations. Other federal regulations include the American Indian Religious Freedom Act (AIRFA), Native American Graves Protection and Repatriation Act (NAGPRA), and the Sacred Lands Executive Order (Executive Order 13007). Chapter II, Section E, Part 2g specifies the program for achieving that compliance, which is outlined below.

Chapter II, Section E, Part 2g states that sites listed on or eligible for the NRHP “will be preserved in place whenever possible. When such resources are threatened by another resource activity or project development an effort (will be made through project design) to avoid or

minimize adverse impact.” When the Forest Supervisor determines that avoidance is not appropriate, “the scientific or historical values of the site will be conserved, in consultant with the SHPO and ACHP, through proper scientific excavation, recordation, analysis, and reporting... [in accordance with] the most current guidelines and Forest Service policy.” (Paragraph 2.) This process will entail:

- An inventory of cultural resources for *most* surface disturbing activities. Well pads require survey of a 10-acre area centered on the impact or the entire APE, whichever is greater. Linear features, such as roads or pipelines, require survey of a 150-foot-wide corridor.
- Evaluation of each encountered cultural resources site according to criteria set forth in 36 CFR 800.4.
- Protection of significant sites from inadvertent or intentional damage or destruction.
- Coordination of cultural resource issues and concerns with appropriate American Indian groups.

This subsection also specifies how human remains will be treated, but those procedures have been superseded by NAGPRA and pursuant regulations, with which they are largely consistent.

Paragraph three of this subsection, which describes the cultural resources inventory process, prioritizes cultural resources surveys by project type. First priority is given to “large areas where substantial development impact is anticipated, such as oil and gas analysis areas.” This appears to commit the Forest Service to conducting inventory-level cultural resource surveys of the Project Area, should this alternative be selected.

New leases under this alternative would also be governed by standard BLM lease terms, as described previously in Section 3.2.2.1, which require archaeological surveys for ground-disturbing developments and allow the Forest Service to relocate proposed wells up to 200 meters from sites proposed by the lessee.

Existing leases continue to be governed by stipulations as described under Alternative 1 until they expire, in which case the stipulations in the current plan, as described above, would take effect.

To understand the level of protection this alternative affords archaeological resources, it is important to note that the plan specifies that archaeological surveys will be conducted for *most* surface-disturbing activities, not all such activities. Surface-disturbing activities are not defined, apparently leaving this distinction to the discretion of the lessee and Forest Service. Standard lease terms also leave the requirement for mitigation actions to the discretion of the Forest Service. Furthermore, it is also not always possible to move proposed well sites less than 200 meters and avoid damage to cultural or other resource values. Actions are also governed by Section 106 of the NHPA, which requires the Forest Service, as a federal agency, to take into account the effects of any licensed or permitted activity, whether or not it is on federal land, on historic properties and to give the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officer (SHPO) a reasonable opportunity to comment regarding the undertaking. That section does not require an agency to mitigate (or require the proponent to

mitigate) the adverse effects of an undertaking. The Custer National Forest, however, in consultation with the SHPO and other consulting parties, including American Indian tribes, develops and evaluates alternatives or modifications to each undertaking to avoid, minimize, or mitigate adverse effects on historic properties.

North Cave Hills

Projected well pads and access roads under this alternative are located either on toe slopes or mesa tops. Two of the projected developments lie within 600 feet of known archaeological sites. Well NCH-12b lies directly between 39HN157 and 39HN158, and its construction would probably have an impact on both sites. These sites are considered eligible for the NRHP. Under physical stipulations of the Forest Plan, there is no place where the well pad can be relocated that is within 600 feet of the projected well site. Therefore, this well and/or its access road will affect one or both historic properties. Well NCH-4B is situated less than 600 feet from sites 39HN184 and 39HN185 and, depending on other siting considerations, could affect them. Both sites are also considered eligible for the NRHP.

All projected well and road locations have not been surveyed for archaeological resources. All are on toe slopes or mesa tops and therefore could affect some of the most scientifically valuable stratified archaeological sites that occur in such settings. However, if these well sites can be relocated to avoid the archaeological sites in question, and no other sites are found at the new locations, then these impacts will not occur.

Indirect effects from these developments could be particularly serious. Development at the projected level--12 new well sites--will greatly increase the number of worker hours at all stages of the oil and gas development process, increasing the probability of impacts from inadvertent and intentional artifact collection and the potential for rock art defacement or other forms of vandalism. Additional roadways and improvements to existing roadways will make the area more attractive to visitors, exacerbating these effects.

Projected well locations are not the only areas that might be affected if the entire North Cave Hills is leased for development. All areas for which surface occupancy is not proscribed, including broad valley bottoms, mesa tops, and toe slopes, might be subject to development. It will not always be possible to relocate proposed well and access developments to avoid significant archaeological resources, even if all areas are adequately surveyed. In addition, vibration from trucks, construction equipment, and drilling rigs can cause damage to cliff faces and increase rock art exfoliation, leading to uncontrollable impacts to these resources. Opening the entire area to development greatly increases the potential for indirect effects of vandalism and artifact collection. It is not possible to quantify the direct and indirect impact of such development on archaeological resources, but that impact can be expected to be substantial.

South Cave Hills

Only one of the ten projected well locations on the South Cave Hills is located within 200 meters of a known archaeological site. Well SCH3b is situated approximately 150 meters from site 39HN516. This site has not been evaluated for eligibility for the National Register. Relocation of this well pad is difficult under stipulations of the Forest Plan, so some impact would probably

be unavoidable. The assessment that projected well sites will affect only one archaeological site is misleading, however. Few archaeological surveys have been conducted in the South Cave Hills and projected well sites are situated near rimrocks and on mesa tops. These are areas that have a high potential for significant archaeological resources, so it is reasonable to expect that some additional well sites or access roads will affect archaeological resources. Direct effects to these resources can be avoided in many cases by relocation of wells and road alignments, but this may not always be possible.

Indirect effects from these developments are likely to be more serious. Development at the projected level will greatly increase the number of worker hours at all stages of the oil and gas development process, increasing the probability of impacts from inadvertent and intentional artifact collection and the potential for rock art defacement or other forms of vandalism. Additional roadways and improvements to existing roadways will make the area more attractive to visitors, exacerbating these effects.

Leasing will open the entire area to potential development on land that is not restricted by physical and biological stipulations. Thus most mesa top, valley bottom, and toe slope settings will be subject to development. These are high probability locations for archaeological sites, particularly the scientifically-most-valuable stratified sites. Most of these sites might be avoided by relocating proposed well heads and access roads as provided for in standard lease terms, but this will not always be possible. Again, there could be substantial but unpredictable and uncontrollable potential impact on rock art and rock alignment structures from vibration. Indirect impacts from artifact collection and vandalism will also occur and cannot be adequately controlled under this alternative.

Slim Buttes

One of the three projected oil wells in this unit is situated on or within 200 meters of a known, significant archaeological site. Projected well SB3B is situated within 15 meters of archaeological site 39HN603, which has not been evaluated for eligibility to the National Register. There appears to be ample area for relocating this well in order to avoid the archaeological site, however, so no impact is anticipated. Although well sites appear unlikely to affect known sites, little of the Slim Buttes has yet been surveyed for archaeological resources. This unit was a particularly important food and resource gathering area in prehistoric and protohistoric times, so large numbers of archaeological resources, particularly those related to hunting and food gathering, can be expected in this area. Therefore, it is possible that other well sites could affect one or more significant archaeological sites. Relocation of the wells and their access roads might be accomplished, however, eliminating most direct impacts from these few well sites. Indirect impacts of artifact collection and looting can be expected, but will be lower than might occur from the more intensive projected developments in the Cave Hills.

Leasing will open the entire area to potential development, which has a great but unquantifiable potential for direct impacts to archaeological sites. As in other units, areas where surface occupancy would be allowed are mesa tops, valley bottoms, and toe slopes, which are the areas where stratified archaeological sites typically occur. Adherence to lease stipulations will eliminate many, but not all, of these impacts. It is again the indirect impacts caused by

increasing public access and bringing additional workers into this area that are of greater concern. Artifact collection and vandalism are likely outcomes of increased public and worker access and these are not controlled by this alternative except by statute. Of particular concern in this unit is the Hidatsa eagle trapping lodge (Slim Buttes Lodge), which could readily fall victim to vandalism or opportunistic use as firewood by area visitors.

East Short Pines

The single well projected for this unit, ESP1, is located 160 m south of archaeological site 39HN549. This area has been more completely surveyed than any other portion of the Project Area. This fact and the location of the well in the center of a broad, sloping ridge make it almost certain that the well can be relocated to avoid impact to 39HN549 and any other nearby archaeological site. Indirect impacts of this minor development are likely to be slight to nonexistent, since it is far removed from most known archaeological sites.

Leasing will open the entire area to development, but such development is not expected to be heavy. If development did occur, however, it would be restricted to toe slopes, ridge tops, and some valley bottoms. Toe slopes seem to be particularly favored for archaeological sites in this unit, since they are a source of toolstone, which was apparently the principal attraction of this area. Development might result in wells or access roads across these landforms and potentially impact significant archaeological sites. Much of this impact can be avoided by project relocation, but some adverse effects are likely to occur. The greater threat of development in this area is from indirect sources: intentional and inadvertent collection. This impact is not quantifiable, but could be extensive if development were to occur on or near any of the many archaeological sites located along the unit's east flank.

West Short Pines

Neither of the well sites projected for this area is situated within 200 meters of a documented archaeological site. Very little of this unit has been surveyed for archaeological sites, however, so it is possible that either or both sites might affect one or more archaeological properties. Ridge tops near these sites are fairly open, however, making it highly likely that wells and roads could be relocated to avoid any significant sites that might exist. The dearth of information about archaeological sites in this area makes it difficult to assess potential indirect impacts. However, if sites exist near these well sites, they are likely to suffer some damage from casual or intentional collection.

Opening the entire unit to development could potentially result in proposals for well sites and access roads on any ridge toe slope or valley bottom settings. This could have unquantifiable direct and indirect effects, as described above for other units.

Cumulative Effects

Impact to archaeological resources is expected to be severe under this alternative, with or without cumulative effects. However, because archaeological sites are nonrenewable resources, and development, trampling by stock, and vandalism are steadily eroding the cultural resource base of the northwestern Plains, cumulative considerations compound the magnitude of the impact of oil

and gas leasing in the project area. Cumulative effects in general are discussed in more detail under section 3.2.2.1.

3.2.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

Management Direction

This alternative would be governed by terms of the Forest Plan and standard BLM lease terms, plus the following stipulations and lease notices:

- The proposed Ludlow Cave Archaeological District will be NSO.
- The North Cave Hills and Slim Buttes will be NSO.
- Each culturally-sensitive site and a ¼-mile buffer around each culturally-sensitive site (rock art, stone circle, cairn, eagle trapping pit, grave, or eagle trapping lodge) will be NSO.
- Land-disturbing activities will be defined to include seismic exploration as well as any activities that require excavation, which include but are not limited to well pad, access road, and pipeline construction.
- Mitigation, as defined in standard BLM lease terms, will be required, whenever practicable, where NRHP-eligible cultural resources are to be adversely affected. Impacts such as the effects of vibration on rock art sites and rock alignments are not predictable in advance, and mitigation of such effects is not considered practicable.
- Personnel of the Lessee or Operator organization will be required to undergo cultural resources sensitivity training by reading a brochure about cultural resource importance and protection before beginning work on National Forest lands. This education will be conducted at lessee expense.
- The lessee will be required, at its own expense, to post signage and/or maintain existing signage at each primary entrance into Forest Service land by which it gains access to its leases. Said signage will remind visitors to respect cultural resources and obey the Archaeological Resources Protection Act.

Making the North Cave Hills (NCH) and Slim Buttes (SB) both NSO is projected to result in relocation of five (NCH) and one (SB) well sites and associated roads outside National Forest lands. These developments would continue to be governed by NHPA Section 106, however. Because the locations of well pads outside National Forest boundary are unknown, potential impacts of this alternative in the Slim Buttes and North Cave Hills vicinities can only be considered generically. Existing leases continue to be governed by terms as described under Alternative 1. Upon expiration of the leases, any new lease on the land would be governed by the stipulations and conditions described here.

North Cave Hills.

Well pads and access roads under this alternative are expected to be on toe slopes outside Forest boundaries. It can be expected that all future well and road locations off the forest have not been surveyed for archaeological resources. All are likely to be on or near toe slopes and therefore

could affect some of the most scientifically valuable stratified archaeological sites that occur in such settings. However, because locations of these well sites will remain under standard BLM lease terms, archaeological survey and mitigation are required. It should, therefore, be possible to relocate well pads to avoid impact to any new archaeological sites. If relocation is not possible, impacts would be mitigated by required data recovery.

Despite the fact that the entire North Cave Hills will be NSO, it will still be subject to seismic exploration and road construction. Vibration from trucks used for seismic exploration can cause damage to cliff faces and increase rock art exfoliation, leading to uncontrollable impacts to rock art, rock alignments, and cairns resources. A large proportion of known rock art sites, including those in the Ludlow Cave Archaeological District, will be subject to such effects.

It is not possible to quantify the direct impact of such development on archaeological resources, but that impact will largely be minimized by the requirement including seismic exploration under land-disturbing activities and requiring mitigation in the lease stipulations. Although there will still be direct impacts to archaeological resources, those direct impacts will be much less than seen under Alternative 2, but are likely to be greater than under Alternative 1.

Indirect effects from these developments might still occur under this alternative, since worker education and public signage will not successfully reach all parties, but they will be lower than expected under Alternative 2. This is especially true because access roads will not be improved to the degree expected under Alternative 2, and therefore public access will be less. Due to signage, impact from collection and vandalism that occurs under the No Action alternative can reasonably be expected to decline also.

South Cave Hills

None of the nine projected well locations in the South Cave Hills is located within 200 meters of a known archaeological site. Few archaeological surveys have been conducted in the South Cave Hills, however, and some projected well sites are situated near rimrocks, on mesa tops, and on toe slopes. These are areas with a high potential for significant archaeological resources, so it is reasonable to expect that at least some well sites or access roads will affect archaeological resources. Direct effects to these resources can be avoided in many cases by relocation of wells and road alignments, but this may not always be possible. Lease terms will, however, require mitigation of impacts in all cases that are outside existing lease areas.

Leasing will open this entire unit to potential development on any land that is not restricted by physical, biological, or sensitive cultural site stipulations. Thus most mesa top, valley bottom, and toe slope settings will be subject to development. These are high probability locations for archaeological sites, particularly the scientifically most-valuable stratified sites. Requiring archaeological surveys for seismic exploration activities in addition to wells and roadways will reduce the impact of this activity on sites. Most sites that might be affected by well or road placement might be avoided by relocating the developments, as provided for in standard lease terms, but this will not always be possible. Some sites might be affected, but mitigation of these impacts will be required, so the loss to the base of knowledge about these resources will be minimized. Again, there could be substantial but unpredictable and uncontrollable potential

impact on rock art and rock alignment structures from vibration. These effects cannot be mitigated

Indirect impacts from artifact collection and vandalism might be expected to occur due to increases in the number of workers and improvements to public access. These impacts will be lower than for Alternative 2, due to worker education and signage, and may even decline from the levels to be expected under Alternative 1.

Slim Buttes

Relocation of well pads and related developments off Forest lands will reduce but not eliminate the potential impact to cultural resource sites on the buttes themselves. Seismic exploration can still be expected in this area and development will lead to an increase in the number of people who are visiting the area for work and, presumably, recreation. Little of the Slim Buttes has been surveyed for archaeological resources, so little is known about the location or significance of sites there. However, this unit was a particularly important food and resource gathering area in prehistoric and protohistoric times, so large numbers of archaeological resources, particularly those related to hunting and food gathering, can be expected in this area. Therefore, it is possible that seismic exploration activity could affect one or more significant archaeological sites. The potential severity of these impacts will be lessened relative to Alternative 2 by requiring mitigation of impacts in all cases.

Although surface occupancy will be prohibited in the area, any developments needed for exploiting any discovered petroleum resources would presumably still be located in close proximity to the buttes, probably on ridges and toe slopes located off-forest. Leasing will open this entire edge area to potential development, which has a great but unquantifiable potential for direct impacts to archaeological sites. Areas where surface development might occur include valley bottoms, and toe slopes, which are the areas where stratified archaeological sites typically occur. Adherence to lease stipulations will eliminate many, but not all of these impacts. Inclusion of seismic exploration under activities requiring archaeological survey and the requirement of mitigation for any unavoidable impacts to significant properties will reduce the effects of this alternative relative to Alternative 2 on Forest lands. Impacts from off-forest activities might be as great or greater than they would have been under Alternative 2. Impacts will certainly remain greater under this alternative than under Alternative 1.

Indirect impacts caused by the arrival of additional workers into this area are of concern, although the absence of new and improved roads will leave public access at about present levels. Artifact collection and vandalism are still likely to occur under this alternative, but will be less than for Alternative 2 due to reduced access, signage, and worker education. Impacts from this source might even be lessened relative to Alternative 1, as a result of improved signage.

East Short Pines

The single well projected for this unit is not near any known archaeological site. This area has been more completely surveyed than any other portion of the Project Area. This fact and the location of the well in the center of a broad, sloping ridge make it unlikely that an archaeological

site will be affected. Indirect impacts of this minor development are likely to be slight to nonexistent, since it is far removed from most known archaeological sites.

Leasing will open the entire area outside portions designated as NSO under this alternative to development, but such development is not expected to be heavy. If development did occur, however, it would be restricted to toe slopes, ridge tops, and some valley bottoms. Toe slopes seem to be particularly favored for archaeological sites in this unit, since they are a source of toolstone, which was apparently the principal attraction of this area. Development might result in seismic exploration, wells, or access roads across these landforms and potentially impact significant archaeological sites. Much of this impact can be avoided by requiring seismic activity to be preceded by archaeological survey and by relocating projects. Any unavoidable impacts would be lessened by required mitigation. Signage and worker education would reduce the indirect impacts from intentional and inadvertent collection. This impact is not quantifiable, but would be less than expected under Alternative 2 and might be less than Alternative 1 due to greater public awareness of cultural resources laws.

West Short Pines

Neither of the well sites projected for this area is situated within 200 meters of an archaeological site. Very little of this unit has been surveyed for archaeological sites, however, so it is possible that either or both sites might affect one or more archaeological properties. Ridge tops in the vicinity of these sites are fairly open, however, making it highly likely that wells and roads could be relocated to avoid any significant sites that might exist. The dearth of information about archaeological sites in this area makes it difficult to assess potential indirect impacts. However, if sites exist near any of these well sites, the sites are likely to suffer some damage from casual or intentional collection. This damage will be less than experienced under Alternative 2, however, due to worker education and signage.

Cumulative Effects

Cumulative impacts will increase the severity of impacts under this alternative because archaeological sites are nonrenewable resources, and development, trampling by stock, and vandalism are steadily eroding the cultural resource base of the northwestern Plains. These effects, and cumulative effects in general are discussed in detail under section 3.2.2.1. Cumulative considerations compound the magnitude of the impact of oil and gas leasing in the project area. Land use restrictions and additional lease requirements, however, should keep impacts below a level of significance. By enhancing understanding of cultural resources laws and values through signage, this alternative might produce a slight decline in cumulative loss of the resource from collecting and vandalism by altering people's behavior toward cultural resources elsewhere in the region.

3.3 ISSUE 3: TRADITIONAL CULTURAL PROPERTIES

Traditional Cultural Properties (TCPs) are properties that derive their significance from “association with cultural practices or beliefs of a living community that a) are rooted in that community’s history and b) are important in maintaining the continuing cultural identity of the community” (Parker and King 1990). A TCP might be a place where plants used in medicine or ritual have long been collected, the site of an historical event significant to that community’s identity, or a place important for the continuing practice of a traditional religion, such as a sacred landscape. There is concern from American Indian communities that TCPs important to them may be affected by oil and gas development and production activities. The Crow, Cheyenne, Hidatsa, and Sioux have expressed concern over the proper treatment of traditional cultural properties and burials located in the project area. Ludlow Cave is located in the North Cave Hills and is considered one of the most important sites in the state of South Dakota as well as being considered sacred to the Arikara, Cheyenne, Hidatsa, and Sioux. The Slim Buttes is also treated as a TCP on the basis of anecdotal, archaeological, and historical evidence that it had important spiritual and subsistence uses that in some cases continue to be important to the modern Sioux and Hidatsa. An additional category of cultural site, the culturally sensitive site, is included here. Culturally sensitive sites are “cultural resources associated with traditional Indian ceremonies, cultural practices, and important events in tribal history” (Deaver and Kooistra-Manning 1995). Introduction of noise, pollutants, visual intrusions, and interruptions may threaten the seclusion and serenity necessary for traditional cultural practices. Vandalism of rock art and other features might damage these items to the point they can no longer be used for their current cultural purposes. The information about traditional cultural properties presented in the following sections is based on the technical report entitled *Ethnography of the Cave Hills, Slim Buttes, Short Pine Hills, and Vicinity*, on file at the Custer National Forest Supervisor’s Office.

3.3.1 AFFECTED ENVIRONMENT

3.3.1.1 Description of Historic Cultural Landscape

Over the past 700 years, multiple ethnic groups have occupied this region of the Great Plains. The first recognizable group, the Mandan/Hidatsa, occupied farming villages on the middle Missouri River and hunted the upper Grand River drainage in summer. By around AD 1400, the Crow split off from the Hidatsa to become full-time nomadic hunters. They coexisted with another nomadic people, the Kiowa-Apache (Naishan Dene), for approximately 200 years, after which they were joined in the region by the Kiowa. Between AD 1600 and 1700 these three groups allied in opposition to the Eastern Shoshone, who had expanded onto the northwestern Plains from the Great Basin. By around AD 1700, the Arapaho had moved into the region from their eastern woodland homes, and by the late 1700s they were joined by two branches of the Cheyenne, who also came from farming communities in the eastern woodlands. After a smallpox epidemic in 1880-81, the Arikara, who had been living at the mouth of the Cheyenne River, scattered among Mandan and Cheyenne communities. The Crow shifted their bases westward out of the project area at this time and the Kiowa and Naishan Dene had moved south into the Black Hills and western Nebraska. The Lakota (Teton Sioux) reached the Black Hills by 1775 and controlled that area by 1800. During the early decades of the nineteenth century, the Lakota were battling the Mandan, Hidatsa, and Arikara for control of the Grand River country,

sometimes with American soldiers as allies. By 1850, the Lakota, with the Cheyenne and Arapaho as allies, controlled the western Dakotas, and in 1851 they entered into a first treaty with the United States. In 1868, western South Dakota, including the project area, was designated the Great Sioux Reservation, which was occupied by Cheyenne and Lakota tribes. Following the 1876 Battle of Little Bighorn, their holdings were reduced to the smaller reservations they now occupy along the Missouri River. The Mandan, Hidatsa, and Arikara (the Three Affiliated Tribes) coalesced in 1861 and agreed to live on the Fort Berthold Reservation in 1870. (Lowie 1935; Wood and Downer 1977; Gunnerson and Gunnerson 1971; Reher and Frison 1980; Mooney 1898; Clark 1982; Trenholm 1970; Bamforth 1988; Hoebel 1978; Grinnell 1923; McGinnis 1990; New Holy 1998.)

It is evident from this history that the Mandan, Hidatsa, Arikara, Crow, Cheyenne, Arapaho, Lakota, Kiowa, Kiowa-Apache, and Eastern Shoshone may all have an interest in the project area. Ethnographic and ethnohistorical records show that the area was an important hunting ground. Forested mesas provided good food, water, and thermal cover for bison and other big game, and offered woods, stone, minerals, and other natural resources that the more level surrounding prairies lacked. The Slim Buttes, in particular, were important as a hunting, berry picking, and winter camping area (Boller 1972; McLaughlin 1910; Vestal 1957, 1984) for the Lakota. The Cheyenne used the lowlands between the Buttes, which today comprise the Sioux Ranger District, for antelope hunts. Eagles were captured for their feathers in the rimrocks of the Cave Hills, East Short Pines, and Slim Buttes, as indicated by the occurrence of a Hidatsa eagle trapping lodge in the former and eagle trapping pits in the latter two (Will 1909; see DEIS Section 3.2). Despite these resource interests to hunting and gathering tribes of the past, it is the spiritual importance of the Cave Hills, and in particular Ludlow Cave and ancestral graves in that area, that continues to have the greatest cultural significance. The site of the Battle of Slim Buttes, which is situated just east of the Slim Buttes Unit, remains culturally important as a place where many Lakota under the leadership of American Horse were killed by troops commanded by General Crook (see DEIS Section 3.2). The tribes also know this area as a source of culturally important plants and mineral pigments, but no specific information is currently available on which items are of interest or where they are found.

The Standing Rock Sioux and Lower Brule Sioux tribal councils and representatives of the Crow and Oglalla Sioux tribes have expressed their interest in the cultural properties in the project area and their concern for protection of these properties. The two tribal councils have issued nearly identical resolutions, the key paragraphs of which are exemplified by the statement of the Standing Rock Sioux:

... BE IT RESOLVED, that the Standing Rock Sioux Tribe, in consultation with the Tribal Historic Preservation officer, asserts its claim that the North Cave Hills area is a sacred site within our Aboriginal Homelands, and cultural/burial sites, National Register Sites, and a National Historic Landmark site identified within the 77,330 acres under custodial responsibility of the Custer National Forest demand the protection under current existing laws; ... (Standing Rock Sioux Tribe Resolution No. 596-97.)

The resolution from the Lower Brule Tribal Council differs only in referring to consultations with the Standing Rock Sioux rather than the Tribal Historic Preservation Officer (Lower Brule Sioux Tribal Council Resolution 98-336).

3.3.1.2 The North Cave Hills and Ludlow Cave

In consultations with the Lakota and the Three Affiliated Tribes, and through ethnographic and ethnohistorical research, the Forest Service has learned that the Cave Hills, or more specifically the North Cave Hills, is considered a sacred place. The central points of interest in this unit are Ludlow Cave and the abundant rock art, which is used by the Sioux, at least, as an oracle.

Northern Plains Indian tribes attribute special significance to caves, particularly caves that emit a cloud of condensation in winter. Caves are thought to be entrances to the underground world where the spirits of the buffalo herds and other animals are believed to reside in winter and from which they emerged each spring to repopulate the plains with game (Bowers 1950; Walker 1917). Since small herds of bison can be found in winter by the clouds of condensation from their exhalations, caves that emitted such clouds were especially important access points to that underground world. It was generally believed that supernatural beings controlled these access points and released or retained animals' spirits, depending on their own whims and the appeasing actions of people. Buffalo are believed to have first emerged onto the earth from such caves (Hoebel 1978; Bowers 1963; Schlesier 1987; Walker 1917). Some Indians retain the belief that bison will one day re-emerge from the underground world and repopulate the plains.

To the Mandan and Hidatsa, these "buffalo homes" were central places in a cycle of ceremonies known as the Earthnaming Rites (Bowers 1963). The Cheyenne shared the belief in underground havens for buffalo, but also associated deep earth places, such as caves and springs, with female reproductive power (Schlesier 1987; Walker 1983). Ethnographies do not identify Ludlow Cave specifically as a sacred place for either the Cheyenne or Hidatsa. However, ceramics and a pipe identifiable to the ancestral Mandan/Hidatsa, and rock art motifs identifiable as Cheyenne, have been found in the cave (Sundstrom and Keyser 1998). It is likely that the Crow, who branched from the Hidatsa, and the Arikara, who formerly used this area for seasonal hunting, also once made pilgrimages to this site, but no direct evidence of such activity can be found in ethnographies or among art motifs. Indirect evidence of Arikara beliefs comes from accounts of the 1874 visit to the cave by a military party under the command of Colonel George Custer. Custer's scouts, who were primarily Arikara, identified the site as the dwelling place of *Wakan Tanka* (Great Mystery or Great Spirit) and said it was a place where people congregated to pray (Custer 1874).

The Lakota are also known to have revered caves and believed in the concept of underground buffalo homes. There is direct mention in ethnographies of Lakota reverence for this particular cave; one Lakota legend seems to refer to it specifically and most of the offerings found near the surface of the cave floor can be attributed to the Lakota (Will 1909). The Lakota today retain a belief in the sanctity and spiritual importance of Ludlow Cave.

Rock art is also considered sacred to northern Plains tribes, who attribute to it spiritual power (Clark 1885; Badhorse 1979; J. Walker 1983) and in some cases, particularly among the Lakota, use it as an oracle to foretell the future. Rock art is abundant in the cave hills. Some of the art

appears to be narrative, but many designs and whole panels depict religious ceremonies or vision quest activities, or can be linked in some way to the concept of the cave hills as a “buffalo home.” Thus, assertions by modern tribes, ethnographic and ethnohistorical reports, rock art motifs, and archaeological finds all support the concept of the Cave Hills, particularly the Ludlow Cave area of the North Cave Hills, as a traditional cultural property with religious significance.

Making offerings to the spirits that control the cave entrances and taking spiritual guidance from rock art are meditative activities that require solitude, open vistas, and quiet. Disruption of that solitude or the intrusion of drilling rigs, oil and gas wells, buildings, or parked vehicles eliminates the feeling and association of the sacred places of the North Cave Hills and is considered an adverse impact on the TCP.

3.3.1.3 The Slim Buttes

In his interview with a reporter from the Nation’s Center News, the Tribal Historic Preservation Officer for the Standing Rock Sioux Tribe mentioned that his tribe had an interest in the Slim Buttes as the site of the historic battle between troops of General Crook and Lakota under the leadership of American Horse and Crazy Horse. According to the CNF archaeologist, tribal members still visit this site, which is situated east of the Slim Buttes Unit along Highway 79, leaving offerings in apparent commemoration of the dead. The Slim Buttes is also the site of a pole structure believed to be the remains of a Hidatsa eagle trapping lodge, which leads to the suggestion that the Slim Buttes were used as the site of eagle trapping ceremonies (see Deaver and Kooistra-Manning 1995). A few eagle trapping pits have also been found in the Cave Hills and East Short Pines. In addition to its religious significance, the Slim Buttes was a particularly important hunting and food gathering area for the Sioux, Hidatsa, and other tribes (see Technical Report on file at the Custer National Forest Supervisor’s Office). That this importance for subsistence overlapped the sacred realm is witnessed by tales of white buffalo being sighted in the area and of an old woman being found inside a slaughtered bison at this location. Because of this wide range of cultural uses, the Slim Buttes, as a whole, can and will, for the sake of this analysis, be considered a TCP.

3.3.1.4 Ancestral Graves

As noted in the introduction to this section, members of various tribes assert that they have relatives buried in the Cave Hills and are concerned over the protection of those graves. To date, only one possible American Indian grave has been found, but it is reasonable to expect that others might eventually be revealed.

3.3.1.5 Culturally Sensitive Sites

In their ethnographic overview of the Custer National Forest, Deaver and Kooistra-Manning (1995) inferred or were told by tribal representatives that certain localities were culturally sensitive, largely for religious reasons. These are labeled culturally sensitive sites and include cairns and small stone circles or cleared areas used as beds during prayer/meditation visits by individuals, large stone circles, rock art, eagle trapping pits, eagle trapping lodges, sites of battles, and sites where sun dances were once held. Although such sites exist in the project area

(Deaver and Kooistra-Manning 1995), tribal representatives have not called out any specific localities in addition to the North Cave Hills and Slim Buttes Battlefield. Therefore, these site types are not technically TCPs. They are addressed as archaeological sites, in DEIS Section 3.2, under which label impacts to them have already received consideration. In addition, they are accorded special consideration under Alternative 3, below.

3.3.1.6 Existing Environment

The Little Missouri River, which flows west of the Cave Hills and between the Short Pines units, was the approximate western boundary of a great hunting ground that stretched northeast to the Kildeer Mountains and east to Slim Buttes. It was known to the Mandan-Hidatsa as the Land of Beginning, because it was the beginning of plenty and the place where the horse was first introduced to the Northern Great Plains (Beckwith 1938). The Cheyenne held communal antelope hunts on the nearby plains and the Lakota maintained winter hunting camps in the Slim Buttes. It was also a place steeped in mythology (Beckwith 1938; Bowers 1963; Parks 1991) and a locality for the ceremonials associated with the hunt. Notwithstanding this general importance to past cultures, the area today is primarily of religious significance.

North Cave Hills

As noted above, the Cave Hills is a place of religious importance as a Buffalo Home Butte. This significance is not only expressed by informants and in tribal resolutions, but also can be seen archaeologically in the numerous rock art sites, vision quest localities, stone circles, and eagle traps. The North Cave Hills, particularly its southern half in the proposed Ludlow Cave Archaeological District, appears to be the more important of the two butte systems. However, the area has not been entirely surveyed for culturally sensitive sites, and it is possible that such sites are equally dense in the unit's north half.

This unit contains Ludlow Cave, one of the buffalo homes visited by many plains tribes to seek knowledge and to entreat the spirits to release more buffalo onto the plains. It is revered by many tribes, including, at least, the Lakota, Cheyenne, Hidatsa, and Arikara, as one of the places from which buffalo first emerged from the earth. Archaeological evidence shows that offerings have been left at this site continuously from as early as 1300 AD and are still being left there occasionally today (Sundstrom 1996).

South Cave Hills

There is less evidence that the South Cave Hills were also used as a place of religious pilgrimage. Cave Hills in general are often referred to as sacred, but it seems that the North Cave Hills bears the primary distinction. Small numbers of rock art, cairn, and eagle trapping sites have been found here and the only possible Indian grave yet known on the Sioux Ranger District is located here. The area has not been thoroughly surveyed for such sites, however. Some culturally sensitive sites, including stone circles, cairns, rock art, a possible eagle trapping pit and a possible Indian grave have already been documented there. In any case, the place-extant tribal groups have thus far identified as having the greatest significance is the North Cave Hills.

Slim Buttes

This unit was primarily important as a hunting and gathering locale. It is also the site of historical events important to Indian people, including an 1876 battle between the Sioux and the United States Army, and a battle between Sioux and Crow warriors. However, there are no ethnographic descriptions of this area's use for religious purposes, and sites other than the Slim Buttes Battlefield have not been identified by tribal representatives as culturally important. Reports of white buffalo and of the old woman who was found inside a bison's body hint at religious importance, however.

Short Pines

Neither area of the Short Pines is mentioned in ethnohistoric, ethnographic, or modern informant sources as containing any traditional cultural properties, nor of having religious significance. The East Short Pines does, however, contain 21 culturally sensitive sites, including an eagle trapping pit, rock circles, and rock cairns.

3.3.2 ENVIRONMENTAL CONSEQUENCES

Sacred and culturally important places fall under the purview of the NHPA, AIRFA, and the Sacred Lands Executive Order (Executive Order 13007). American Indian graves are protected under NAGPRA.

The 1992 amendments to NHPA specify that properties of traditional religious and cultural importance to an ethnic group (traditional cultural properties, or TCPs) may also be determined to be eligible for inclusion on the NRHP. In carrying out its responsibilities under Section 106, a federal agency is required to consult with any Indian tribe that attaches religious and cultural significance to such properties (16 USC 470a(d)(6)(A) and (B)) when any federal undertaking might affect them.

AIRFA and Executive Order 13007 require federal agencies to consider the effect of proposed undertakings on the ability of Native peoples to practice traditional religions. This consideration is accomplished through formal consultation. One such consultation took place in the North Cave Hills on June 7-9, 1997, when a group of 75 American Indians from ten tribes assembled with Forest Service staff in the North Cave Hills. The aforementioned tribal resolutions were an outcome of that consultation.

NAGPRA provides for protection of Indian graves, regardless of which alternative is under consideration. This law protects graves from intentional disturbance, providing criminal and civil penalties for unpermitted disturbance of graves and for theft and trafficking in skeletal remains or associated objects. It also establishes procedures for disposition of American Indian Remains discovered on federal land after 1990. The Forest Service is required to comply with this statute and its pursuant regulations.

Due to the limitation of TCPs and sacred sites to the Cave Hills and Slim Buttes, only those areas are addressed in the alternatives analysis. It is recognized that any of the alternatives might result in discovery of human graves, but in all cases, treatment of such discoveries is fully addressed under NAGPRA.

The unit of measure for this analysis will be the number and type of traditional cultural properties whose integrity or NRHP eligibility status are affected. The impact of each alternative on Native Peoples' ability to pursue their religious practices in association with TCPs is also considered. These issues are difficult to measure and analysis is addressed qualitatively rather than quantitatively. Effects of concern are impacts to feeling and association of the properties in question and include alteration of the viewshed, auditory and olfactory intrusion, and the likelihood that cultural practices requiring solitude might be interrupted by encounters with other users of the project area.

3.3.2.1 Alternative 1 - No Action, No New Leases

Management Direction

Terms of extant leases make no special mention of TCPs, because all have been in effect since before the amendment of the NHPA. Likewise, they make no mention of AIRFA compliance. However, because TCPs are addressed under the NHPA, it is reasonable to assume that they are covered under the following lease terms.

Stipulations for Leases M54525 (west flank of South Cave Hills) and M54158 (center of the North Cave Hills) include the following language:

The federal surface management agency is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking surface disturbing activities on the lands covered by this lease the lessee or operator, unless notified by the authorized officer of the surface management agency shall:

- 1. Engage the services of a qualified cultural resources specialist acceptable to the Federal surface management agency to conduct an intensive inventory for evidence of cultural resource values.*
- 2. Submit a report acceptable to the (Forest Service) and the District Engineer, Geological survey.*
- 3. Implement mitigation measures required by the surface management agency to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator and materials salvaged will remain under the jurisdiction of the U.S. Government.*

The lessee is also required to immediately notify the Forest Service if any cultural resources are encountered in the course of surface-disturbing activities and to leave such discoveries intact until directed to proceed by the District Engineer, Geological Survey.

These stipulations are designed to keep the Forest Service in compliance with the National Historic preservation Act (NHPA). Items 1 through 4 are covered under Section 106 of that act, which requires the Forest Service, as a federal agency, to take into account the effects of any licensed or permitted activity, whether or not it is on federal land, on historic properties and to

give the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officer (SHPO) a reasonable opportunity to comment regarding the undertaking. That section does not require an agency to mitigate (or require the proponent to mitigate) the adverse effects of an undertaking. If the procedure is followed, the agency may proceed (or allow the proponent to proceed) despite adverse effects. Therefore, in evaluating this alternative and other alternatives, it is appropriate to assume that some significant TCPs might be adversely affected without protection or mitigation.

Cultural resources are not addressed in stipulations for Lease M43521, which covers the north end of the North Cave Hills. However, since the lease dates to 1979, it is reasonable to assume that NHPA Section 106 terms apply.

Although it postdates the leases, NAGPRA applies under this alternative, just as it does to any other federal property. Once leases expire, no new leases are contemplated under this alternative.

North Cave Hills

Development of the two wells that are projected for this unit will result in auditory and visual intrusions in their immediate vicinity but should not affect the feeling and association for pilgrims to the southern portion of the unit, where Ludlow Cave is situated. Any sound from these developments will be dissipated before it reaches the ears of a pilgrim to this site and will be subdued by noise from the nearby ranch. Neither projected well is within sight of the cave or visible from the cliff above.

South Cave Hills

Development of wells along the west side of the South Cave Hills will result in some visual and auditory intrusions to people wishing to use the area for meditative purposes. Since specific portions of the unit that might be important to religious practitioners are unknown at this time, it is not possible to ascertain the severity of this intrusion.

Cumulative Effects

As our national population grows and the west becomes increasingly developed for minerals, residences, and recreational sites, it is becoming increasingly difficult for practitioners of Native religions (or any other for that matter) to find places for meditative observances. Buffalo home caves and rock art sites are rarer than isolated locations once were and become more rare, or harder to utilize, for religious purposes as development progresses. Some buffalo home sites are on federal land and are still accessible, but others may not be. Therefore, reduction in the utility of one more area for solitude or one more buffalo home cave takes on greater importance. Projected development in and around the project area includes development of many additional wells and support facilities for fossil fuels extraction and transport. These activities will increase noise levels, potentially bring new people into the area, and thus provide visual and auditory intrusion to places of meditation.

Effects of Alternative 1 will not reach greater significance when added to other projected developments.

3.3.2.2 Alternative 2 – Lease with Forest Plan Stipulations

Management Direction

This alternative is governed by the Custer National Forest Plan and stipulations in the existing leases that remain in the North and South Cave Hills.

The Forest Plan states in Chapter II, Section D, Part 1 that the Forest will continue to manage cultural resources as directed by the National Historic Preservation Act (NHPA) and other relevant federal regulations (USFS 1987, p. 11). Other federal regulations include the American Indian Religious Freedom Act (AIRFA), Native American Graves Protection and Repatriation Act (NAGPRA), and the Sacred Lands Executive Order (Executive Order 13007). Chapter II, Section E, Part 2g specifies the program for achieving that compliance. Under Chapter II, Section E, Part 8j “Locatable Minerals,” paragraph 3 requires a lessee to prepare a plan of operations if its proposed operations are likely to cause substantial disturbance to surface resources. Among required actions to be included in this plan (subparagraph 1) is a requirement for a cultural resources examination, to be conducted prior to any surface-disturbing activity. Applicable site protection measures are to be included in this plan. No further stipulations are included, so the general procedures outlined in Part 2g should be in effect.

Chapter II, Section E, Part 2g states that Sites listed on or eligible for the NRHP, which includes TCPs, “will be preserved in place whenever possible. When such resources are threatened by another resource activity or project development an effort [will be made through project design] to avoid or minimize adverse impact.” When the Forest Supervisor determines that avoidance is not appropriate, “the scientific or historical values of the site will be conserved, in consultation with the SHPO and ACHP, through proper scientific excavation, recordation, analysis, and reporting... [in accordance with] the most current guidelines and Forest Service policy.” (Paragraph 2.) This process will include:

- An inventory of cultural resources for *most* surface disturbing activities. Well pads require survey of a 10-acre area centered on the impact of the entire APE, whichever is greater. Linear features, such as roads or pipelines require survey of a 150-foot-wide corridor.
- Evaluation of each encountered cultural resources site according to criteria set forth in 36 CFR 800.4.
- Protection of significant sites from inadvertent or intentional damage or destruction.
- Coordination of cultural resource issues and concerns with appropriate American Indian groups.

Existing leases continue to be governed by stipulations as described under Alternative 1. When the leases expire, the area will be governed by the Forest Plan and any new leases would be treated in the same manner as described above.

To understand the level of protection this alternative affords TCPs and sacred sites, it is important to note that standard lease terms also leave the requirement for mitigation actions at the discretion of the Forest Service. Furthermore, it is also not always possible to move projected well sites less than 200 meters and avoid damage to cultural or other resource values.

Actions are also governed by Section 106 of the NHPA, which requires the Forest Service, as a federal agency, to take into account the effects of any licensed or permitted activity, whether or not it is on federal land, on historic properties and to give the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officer (SHPO) a reasonable opportunity to comment regarding the undertaking. That section does not require an agency to mitigate (or require the proponent to mitigate) the adverse effects of an undertaking. It is, however, the policy of the Custer National Forest to mitigate all adverse impacts.

North Cave Hills

Development of the projected 12 new wells in this unit will have a substantial impact on this TCP. Noise from drilling new wells and from workers driving to and from wells, vehicle effluents, and the presence of drilling rigs, heavy excavation equipment, and pumping apparatus will all intrude on the solitude and meditative needs of religious practitioners visiting the buttes. In particular, two wells are likely to be visible from the cliff above Ludlow Cave and sound from their development and operation will be easily heard from the cave environs.

Leasing opens up the entire area to development, which means that wells and roadways might eventually be developed much closer to Ludlow Cave, other rock art sites used as oracles, eagle trapping localities, and other culturally sensitive sites. The resultant intrusion from such developments would virtually eliminate the North Cave Hills and Ludlow Cave in particular from utility as a religious shrine.

Indirect effects of this development result from increased visitation to the unit by workers and by visitors emboldened by improved road systems. These visitors might not respect the privacy of religious practitioners and will add more noise and vehicle effluents to the impacts from oil and gas development. The impact to the feeling and association of Ludlow Cave might be greatest, since this area is currently one of the most remote in the unit.

In summary, this alternative will have a substantial, negative impact on the feeling and association of this TCP, particularly its most important component, Ludlow Cave.

South Cave Hills

Projected well sites are spaced almost evenly along the west half of this unit. As a result, their development and operation will severely interfere with American Indian people's ability to conduct religious observances here, if they choose to do so. However, because it is unclear which area of this unit, if any, is of religious importance, the relevance of this possible impact is unclear at this time. The same is true of development throughout the unit.

Indirect impacts would be similar to those described for the North Cave Hills, but, again, it is not known where or if sacred places on this landform might exist, so the impact cannot be cogently considered.

Slim Buttes

The locality of central importance in the Slim Buttes is the Slim Buttes Battlefield. This locality is situated outside the Forest Service boundary along a paved highway, where it is prominently marked as a place of historic interest. No direct impacts to this site area are expected. One

indirect effect might be an increase in noise if wells were situated in the north end of the Slim Buttes. There might also be a slight increase in visitation to the site by workers brought to the area by oil development. Since the site is already so prominent and easily accessible, however, this impact is expected to be slight.

The only other culturally sensitive sites yet recorded in the Slim Buttes are seven cairn sites and the Slim Buttes eagle trapping lodge. Fossil fuels exploration and development might have a negative impact on Native peoples' use of these sites for religious purposes and, as noted in Chapter 3.2, could result in inadvertent or intentional damage to these sites. None of the projected wells is situated near any of these sensitive locations, but the entire area has not yet been surveyed for such sites. Exploration and development outside the projected well locations could affect the feeling and association of these sites and bring increased visitations by workers and the public that could result in interruption of the solitude needed for the appropriate religious uses.

Because hunting and plant gathering appear to have been the most important cultural uses of this Unit, improvement of roads would make resource gathering sites more accessible. This actually might enhance the ability of American Indian people, particularly the old and infirm, to use the unit for cultural practices.

Short Pines

No TCPS are currently known for these units. There are, however, numerous cairn and stone circle sites in the East Short Pines the future use of which for cultural purposes might be interfered with by development and increased public and worker access.

Cumulative Effects

As our national population grows and the west becomes increasingly developed for minerals, residences, and recreational sites, it is becoming increasingly difficult for practitioners of Native religions (or any other for that matter) to find places for meditative observances. Buffalo home caves and rock art sites are rarer than isolated locations once were and become more rare, or harder to utilize for religious purposes, as development progresses. Some buffalo home sites are on federal land and accessible still, but others may not be. Therefore, reduction in the utility of one more area for solitude or one more buffalo home cave takes on greater importance. Projected development in and around the project area includes development of many additional wells and support facilities for fossil fuels extraction and transport. These activities will increase noise levels, potentially bring new people into the area, and thus provide visual and auditory intrusion to places of meditation.

The impact of this alternative on traditional cultural uses of the Cave Hills would be severe, but is magnified by the parallel loss to religious practitioners of other sites of the same kind in the northwestern Plains.

3.3.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

This alternative removes two management units, the North Cave Hills and the Slim Buttes, from surface occupancy to protect their cultural values. This southern area contains, near its southern terminus, Ludlow Cave, and includes most of the known rock art sites in the unit. This alternative also stipulates that the entire North Cave Hills and the Slim Buttes will be NSO, and places an NSO buffer around culturally sensitive sites in the South Cave Hills, East Short Pines, and West Short Pines. NSO stipulations on the North Cave Hills and Slim Buttes are based on findings presented in the Technical report entitled *Ethnography of the Cave Hills, Slim Buttes, and Short Pine Hills*, which is on file at the Custer National Forest Supervisor's Office. This alternative is governed by conditions in the Forest Plan, as described above. It also requires, as described in Section 3.3.2.1, the stipulation that all surface-disturbing activities, defined to include seismic exploration, will require surveys for cultural sites. This includes surveys for graves, rock art localities, and other culturally sensitive sites. In addition, this alternative requires the following stipulations and lease notices:

- The proposed Ludlow Cave Archaeological District will be NSO. The cultural importance of this area of the North Cave Hills is well documented (see Affected Environment, Section 3.3.1). It also contains such a high concentration of culturally sensitive sites that virtually no spot on its landscape is more than ¼ mile from a sensitive site.
- The North Cave Hills and Slim Buttes will be NSO. A sufficient amount of information is available to support the assertion that each of these areas might be considered, in its entirety, as a traditional cultural property, particularly under the concept of sacred landscape. Information on both areas is incomplete at this time, however, and the Forest Service is taking the precautionary measure of making both areas NSO for purposes of this analysis.
- Each culturally sensitive site (rock art, stone circle, cairn, eagle trapping pit, grave, or eagle trapping lodge) and a ¼-mile buffer around each will be NSO. The ¼-mile buffer was derived during work on the Beartooth EIS through consultation with the tribes. A buffer of this size was approved as a protective measure
- Land-disturbing activities will be defined to include seismic exploration as well as any activities that require excavation, which include but are not limited to well pad, access road, and pipeline construction.
- Mitigation, as defined in standard BLM lease terms, will be required, whenever practicable, where NRHP-eligible cultural resources are to be adversely affected. Impacts such as the effects of vibration on rock art sites and rock alignments are not predictable in advance and mitigation of such effects is not considered practicable.
- Personnel of the Lessee or Operator organization will be required to undergo cultural resources sensitivity training by reading a brochure about cultural resource importance and protection before beginning work on National Forest lands. This education will be conducted at lessee expense.

- The lessee will be required, at its own expense, to post signage and/or maintain existing signage at each primary entrance into forest service land by which it gains access to its leases. Said signage will remind visitors to respect cultural resources and obey the Archaeological Resources Protection Act.

NSO stipulations in North Cave Hills, Slim Buttes, and around culturally sensitive sites may change as more information is obtained through tribal consultations.

Existing leases will continue to be governed by lease terms plus NAGPRA. When existing leases expire, the land would fall under stipulations of the Forest Plan and any new leases would be governed under stipulations and mitigations stated above.

North Cave Hills

Removal of the Ludlow Cave Archaeological District from surface occupancy will greatly lessen the impact of oil and gas development on use of the Ludlow Cave TCP and the southern portion of the North Cave Hills. No longer would any developments be visible from the cave or its cliff-top, and sound from developments would not be substantial. Placing NSO restrictions on the rest of the North Cave Hills eliminates much of the expected potential intrusion on the solitude of religious practitioners. Some intrusion is anticipated during seismic exploration of this unit, which will remain open to leasing. Intrusion by workers and the public will be lessened because development will not entail improvements to access roads, and fewer workers and fewer worker hours are expected to be involved on the unit. Inclusion of stipulations requiring signage and worker education would reduce the level of intrusion from area visitors.

The development of wells and construction of access roads off-Forest, necessitated by the NSO stipulation, would be expected to generate some noise and create visual intrusions that might diminish the meditative ambiance that is required by religious practitioners. This intrusion is, however, expected to be less than the intrusion expected by developments under Alternative 2.

South Cave Hills

Impacts and their importance are similar for this alternative as for Alternative 2, except that the indirect impacts due to increased worker and visitor traffic should be lessened through education. Also, the ¼-mile buffer will minimize the impact on uses of culturally sensitive sites.

Slim Buttes

Impacts to cultural uses of this area are expected to be mixed for this alternative on the portions of the buttes that are under federal control. The key element affecting cultural uses is access, which would not be enhanced if the entire Slim Buttes were NSO. Reducing access would on the one hand limit public use to approximately current levels, thus minimizing the potential for inadvertent or intentional impact to sensitive sites, particularly the Slim Buttes Lodge. However, the enhancement of access to resources by American Indian people that is expected under Alternative 2 would not occur. In addition, a large part of the Slim Buttes environment that was formerly important as a hunting and gathering area lies off-Forest. Likewise, the Slim Buttes Battlefield lies off-Forest. Making the federally owned portion of the Slim Buttes NSO does not eliminate the effect of leasing on the cultural value of these areas. In fact, it could diminish

people's experience during religious observances at the Battlefield site by bringing roads and well sites closer than they might be if they were on Forest land. Impacts and their importance are thus nearly the same or even slightly higher for this alternative than for Alternative 2, except that indirect impacts due to increased worker traffic should be lessened through education.

East and West Short Pines

Impacts to potential cultural uses of sensitive sites on these units would be diminished relative to Alternative 2 because of the ¼-mile NSO buffer around each of these sites.

Cumulative Effects

Exploration activity on and development of the areas around the North Cave Hills would add minimally to other losses of places of solitude. However, because the Ludlow Cave area the North Cave Hills would be NSO, and because of efforts to educate workers and the public about the importance of this area, impacts will be reduced. Education of both groups might result in reduced impacts to other areas of similar importance elsewhere in the region. The result will be a cumulative loss, but when all influences are taken into consideration, that loss would be minor, and certainly much lower than expected under Alternative 1. In fact, because of the potential improvements that should result from signage and worker education, this alternative might have slightly lower impact to TCPS than Alternative 1.

3.4 ISSUE 4: VISUAL RESOURCES

Each of the five land units within the Sioux Ranger District stands out like islands from the sea of prairie and agricultural development surrounding them. Their striking contrast to the nearby terrain of range and croplands results in a unique visual experience. Oil and gas exploration, development, production, and rehabilitation activities have the potential to affect this visual experience.

The scenic quality of the Sioux Ranger District, Custer National Forest has aesthetic value in and of itself and is an important factor in the quality of the recreation experience enjoyed by numerous forest visitors.

This section describes the scenic resources in the Sioux Ranger District that may be affected by the alternative oil and gas leasing scenarios being considered. The stated goal of visual resource management is to “maintain the overall natural appearing landscape recognizing that there are some activities that will be affected by management activities” (USFS 1987, page 4).

3.4.1 AFFECTED ENVIRONMENT

3.4.1.1 General Description of Custer National Forest, Sioux Ranger District Scenic Resources

The Sioux Ranger District is characterized by rolling hills, grasslands, and scattered pine trees with unique rocky buttes such as the Castles National Landmark rising above. The region is sparsely populated with a few small towns in the area. Most of the Forest's landscape has a natural appearance with the exception of some oil and gas developments. The existing oil well pumps and tanks have been painted to match the color of the surrounding grasslands. Due to the unique rocky formations and the dark contrast of the existing pine trees, the developments generally blend in with the surrounding landscape. A very small portion of the Ranger District is characterized by modifications, including oil well pumps and tanks, roads, fuelbreaks, special use sites, and utility lines. Most of the Sioux Ranger District has an appearance characteristic of the region as a whole (USFS n.d.).

Hunting is the primary form of recreation in the Sioux Ranger District, taking place mainly in the fall season (Leibert 1997). Visitors are also attracted to the unique landforms. Various sites within the Sioux Ranger District are considered sacred to Native Americans and the natural state of the landscape has allowed traditional cultural use to continue. The Sioux Ranger District receives approximately 8,800 visitors per year.

Landscape Character

The Custer National Forest is situated within the Big Dry and Middle Missouri Character Type. Landscapes within the Sioux Ranger District generally have very steep slopes and deeply dissected landforms with numerous large rock outcrops.

The dominant natural vegetation consists of a wheatgrass-needlegrass and shortgrass mixed steppe. Woodlands are rare and occur mostly as woody draws in drainages or as isolated ponderosa pine parklands.

Climate

Harding County's climate is characterized by hot dry summers with occasional thunder and lightning storms as well as cold snowy winters with northern winds. Two major vegetation types mantle the Forest's landscape: dispersed pine forest and grassland. Harding County covers six watersheds: the Upper Little Missouri, Boxelder, North Fork Grand, South Fork Grand, South Fork Moreau, and Upper Moreau. Major streams located within the forest boundary are Russell Creek in the Ekalaka Hills, and Castle Creek and Teepee Canyon Creek near the Castles National Landmark. The Slim Buttes area has several other creeks including Jones Creek, Beaver Creek, and Antelope Creek. Numerous springs are located throughout the Ranger District.

3.4.1.2 Forest Management Plan Directive: Scenic Resources

The Custer National Forest Land and Resource Management Plan guides scenery management activities within the Sioux Ranger District (USFS 1987, p. 14). An inventory of scenic resources (Scenic Attractiveness, Variety Class, and Visibility) using the Visual Management System was conducted by the Sioux Ranger District, and Visual Quality Objectives have been established for each Management Area (MA) within the Forest. The Visual Management System has since been replaced by the Scenery Management System described in Agriculture Handbook 701, Landscape Aesthetics.

Scenic Attractiveness

Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape. Elements evaluated include landform, vegetative characteristics, surface water characteristics, and cultural features. Scenic attractiveness is classified as either distinctive (Class A), typical (Class B), or indistinctive (Class C). Table 3.4-1 lists the percent and amount of acres in each scenic attractiveness class for the areas being considered for oil and gas leasing.

Table 3.4-1. Scenic Attractiveness Classes by Unit*

Unit Areas	Class A Distinctive	Class B Typical	Class C Indistinctive	Unclassified Acreage	Total Land Area
North Cave Hills	Acres: 0 Percent: 0	Acres: 10,052 Percent: 69	Acres: 3,891 Percent: 27	604	14,547 acres
South Cave Hills	Acres: 0 Percent: 0	Acres: 4,993 Percent: 56	Acres: 3,370 Percent: 38	513	8,876 acres
Slim Buttes	Acres: 452 Percent: 1	Acres: 36,921 Percent: 79	Acres: 6,200 Percent: 13	3,850	46,972 acres
West Short Pines	Acres: 0 Percent: 0	Acres: 907 Percent: 72	Acres: 158 Percent: 13	199	1,263 acres
East Short Pines	Acres: 0 Percent: 0	Acres: 5,533 Percent: 90	Acres: 540 Percent: 9	74	6,147 acres
Total Areas Considered for Lease	Acres: 451 Percent: 0.5	Acres: 58,405 Percent: 75	Acres: 14,767 Percent: 18	4,787	77,805 acres

*Acreages in this table may not represent actual scenic conditions due to constraints when data was gathered and should be revisited at the time of permitting or lease issuance. Acres have been rounded to the nearest whole number.

Visibility

Landscape visibility addresses the relative importance of scenery as seen from selected viewing locations, such as along roads and trails. Visibility has been broken into three distance zones:

- **Foreground**—Detailed landscape generally found from the observer to one-half mile away.
- **Middleground**—The zone between the foreground and the background, from 0.5 mile to 4 miles from the observer.
- **Background**—The distant part of the landscape located from four miles to infinity from the viewer.

Table 3.4-2 identifies acres of land within each unit that have been designated as Foreground, Middleground, or Background as viewed from main roads throughout the proposed units within the Sioux Ranger District.

Table 3.4-2. Viewshed Distance Zones by Acre*

Unit	Foreground (acres)	Middleground (acres)	Background (acres)	Undesignated (acres)	Total
North Cave Hills	1,611	7,728	4,602	606	14,547
South Cave Hills	727	5,317	2,138	694	8,876
Slim Buttes	7,125	21,032	11,279	7,536	46,972
West Short Pines	271	568	226	199	1,264
East Short Pines	1,295	4,123	656	74	6,147
Total Acres	11,029	38,768	18,900	8,836	77,805

*Acres have been rounded to the nearest whole number.

Visual Quality Objectives (VQOs)

Visual Quality Objectives (VQOs) adopted by the Forest Plan (USFS 1987, p. 14) were established through the application of a nationwide and regionwide system of land classification and scenery management called The Visual Management System. This established “inventoried Visual Quality Objectives.” In support of emphasis for each management area, the inventoried VQOs were adjusted through an interdisciplinary process that resulted in raising or lowering the inventory VQOs, which then became the Forest Plan VQOs.

The Custer National Forest Land and Resource Management Plan VQOs are expressed as minimally acceptable standards to maintain the scenic integrity of an area. The VQOs vary from *preservation* to *maximum modification* (USFS 1987, pages 41-98).

The VQOs allow for alterations of the natural landscape consistent with the following VQO definitions:

- **Preservation**—Allows for ecological changes only.
- **Retention**—Human-created activities are not evident to the casual forest visitor.

- **Partial Retention**—Human activities may be evident but must remain subordinate to the characteristic landscape.
- **Modification**—Human activities may dominate the characteristic landscape, but must utilize naturally established form, line, color, and texture so they are viewed as a natural occurrence when viewed in the foreground or middleground.
- **Maximum Modification**—Human activities may dominate the characteristic landscape but should appear natural when viewed as background (greater than four miles).

Existing Scenic Conditions (ESC)

Existing scenic condition is the current state of the landscape considering previous human alterations. Scenic conditions differ from VQOs in that VQOs are expressions of minimal acceptable level for scenic conditions.

Existing Scenic Condition Classes are as follows:

- Very High (Unaltered)
- High (Appears Unaltered)
- Moderate (Slightly Altered)
- Low (Moderately Altered)
- Very Low (Heavily Altered)
- Unacceptably Low

Specific mapping of existing scenic conditions is not available; but in general, existing conditions meet the prescribed VQOs (personal communication, Laurie Walters-Clark, Contracting Officer's Representative, Custer National Forest, October 30, 2002).

In the Custer National Forest, roads, fuelbreaks, oil and gas developments, special use sites, pumping stations, and utility lines are the principal types of human alterations that have been classified as Existing Scenic Conditions (ESC) classes 4, 5, and 6.

Table 3.4-3 describes the six types of existing scenic conditions found within the lands being considered for lease. It also describes the correlation to adopted VQOs, and the time frames within which the VQOs must be met by new activities such as oil and gas development.

There are 77,806 acres (87 percent) of the Sioux Ranger District, Custer National Forest that can be considered for oil and gas leasing.

Table 3.4-3. Existing Scenic Conditions, VQOs, and Compliance Timing Requirements

Scenic Condition	Description of Scenic Condition	VQO	Description of VQO	Time Frame to Meet VQO
Unaltered Landscape	Areas in which only ecological change has taken place, except for trails needed for access. These landscapes appear to be untouched by human activity.	Preservation	This VQO allows ecological changes only. Management activities, except for very low visual-impact recreation facilities, are prohibited.	At completion of facility construction.
Appears Unaltered	Areas in which changes in the landscape are not visually evident to the average person unless pointed out. They appear to be unnoticed alterations.	Retention	This VQO provides for management activities that are not visually evident. Under retention, activities may only repeat form, line, color, and texture that are frequently found in the characteristic landscape. Changes in qualities of size, amount, intensity, direction, pattern, etc., should not be evident.	Retention should be achieved concurrent with the beginning of surface-disturbing activities and be maintained throughout the duration of operations.
Slightly Altered	Areas in which changes in the landscape are noticed by the average forest visitor, but they do not attract attention. The natural appearance of the landscape still remains dominant. Activities appear to be minor disturbances.	Partial Retention	Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention VQO. Activities may repeat form, line, color, or texture common to the characteristic landscape but changes in their qualities of size, amount, intensity, direction, pattern, etc., remain visually subordinate to the characteristic landscape.	Reduction in contrast to meet partial retention should be achieved within six months of the beginning of surface-disturbing activities and maintained throughout the duration of operations.

Table 3.4-3. Existing Scenic Conditions, VQOs, and Compliance Timing Requirements (cont'd)

Scenic Condition	Description of Scenic Condition	VQO	Description of VQO	Time Frame to Meet VQO
Moderately Altered	Areas in which changes in the landscape are easily noticed by the average forest visitor and may attract some attention. Activities appear to be disturbances but resemble natural patterns.	Modification	Management activities may visually dominate the original characteristic landscape. However, activities of vegetative and landform alteration must borrow from naturally established form, line, color, and texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Additional parts of these activities such as structures, roads, etc., must remain visually subordinate to the proposed composition.	Reduction in contrast to meet modification should be achieved within one year of the beginning of surface-disturbing activities and be maintained throughout the duration of operations.
Heavily Altered	Areas in which changes in the landscape are strong and could be obvious to the average forest visitor. These changes stand out as a dominating impression of the landscape. Yet they are shaped so that they might resemble natural patterns when viewed from three to five miles or more distance. Activities appear to be major disturbances.	Maximum Modification	Management activities of vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middleground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail that is incongruent with the natural occurrences as seen in foreground or middleground.	Reduction of contrast to meet maximum modification should be achieved within five years of the beginning of surface-disturbing activities and be maintained throughout the duration of operations.
Unacceptably Altered	Areas in which changes in the landscape are in glaring contrast to the natural appearance. Almost all forest visitors could be displeased with the effect. Activities appear to be drastic disturbances.	Unacceptable Modification	This is not a VQO. Size of activity is excessive, poorly related to scale of landscape, overall extent is excessive, or activities & facilities contrast in form, line, color, or texture. Visual elements are unrelated to those in the characteristic landscape.	Not applicable

3.4.1.3 Affected Environment by Unit

Narrative descriptions of the scenic character of each land unit within the study area are presented below.

North Cave Hills

The North Cave Hills unit (14,547 acres) is located in the northern part of the Sioux Ranger District near the state borders of South Dakota, North Dakota, and Montana, approximately 30 miles north of the town of Buffalo, SD. The North Cave Hills unit is characterized by Rimrock Breaks, Ponderosa Slope, and Upland and Rolling Grassland (Slacks 1996). The brown Rimrock Breaks rising from the beige grasslands create visual uniqueness and contrast in color, texture, and form within the area. The dark green Ponderosa trees on the grasslands that slope away from the rimrock also create contrast.

There are two large areas, one to the north (2,423 acres) and another in the center (358 acres) of existing oil and gas leases within this unit, totaling 2,784 acres. There are currently three wells, two oil and one injector, within these leasing areas. All three wells are located within Management Area E (Minerals Management). Two are located in the Background and one is located in the Foreground. Figure 3.4-1 demonstrates the visual appearance of the existing oil and gas leasing activity in this land unit. Although the facilities are visible, they blend in with the surrounding colors and do not detract substantially from the uniqueness of the rimrock feature.

There are several Management Areas within the North Cave Hills unit as demonstrated in Table 3.4-4 and Figure 3.4-2 in the accompanying map packet.

Table 3.4-4. Management Areas, Acres, and Prescribed VQOs in the North Cave Hills

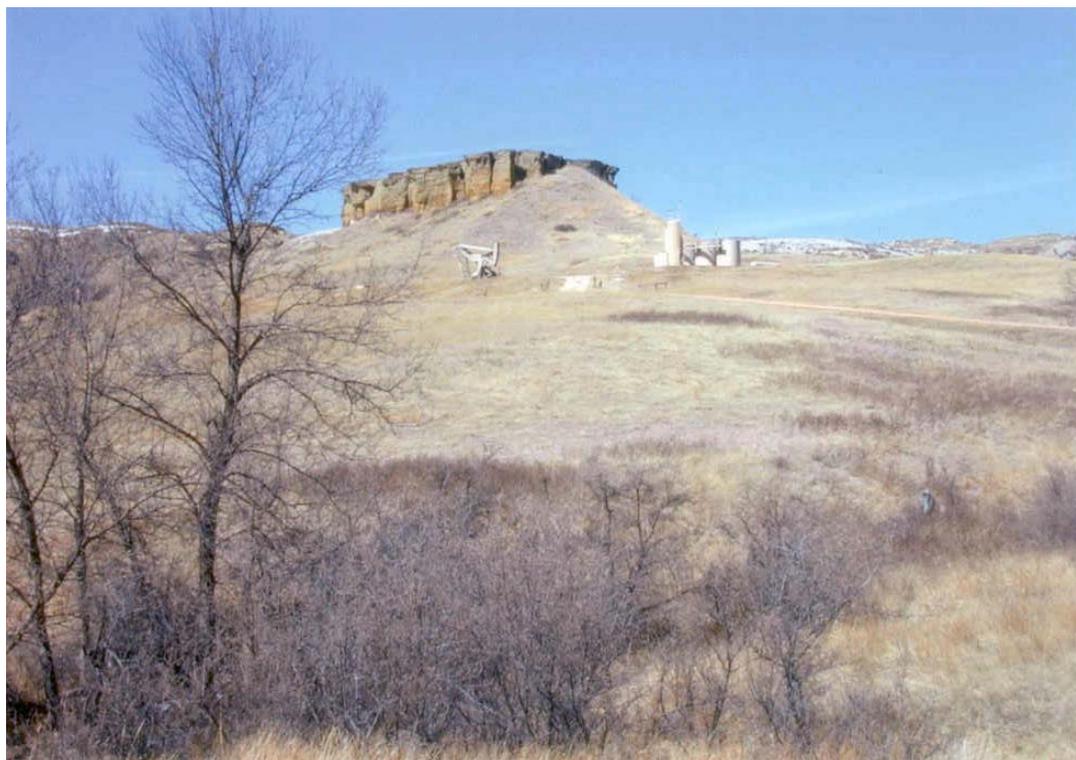
Management Area	Acres	Prescribed Visual Quality Objectives (VQOs)
C – Rimrock	1,979	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape.
E – Minerals Management	11,341	VQOs will include Retention, Partial Retention, and Modification. Short-term degradation will likely occur during mineral development that will not meet the assigned VQO of the area. Emphasis will be on rehabilitation immediately after the development phase and at the completion of production
F – Developed Recreation	30	VQOs in the foreground viewing area from a developed site or along an access corridor will be either retention or partial retention. The Existing Visual Condition (EVC) will not drop below the current situation and in any circumstances in which the EVC is in class 4, 5, or 6, rehabilitation will take place. Development of facilities will be designed to meet the VQOs.
M – Riparian	130	VQOs will be Retention and Partial Retention. The natural-appearing landscape will remain dominant and most management activities will not be evident.
N – Woody Draws	939	VQO of Retention will be met in this area except where crossed by roads.

Source: USFS 1987, pages 50, 58, 61, 62, 80, and 83.

The largest area, designated as Management Area E (Minerals Management), is compatible with oil and gas leasing activities. Figure 3.4-1 demonstrates how these activities can meet the Visual

Quality Objective or be mitigated to meet the prescribed VQO. Approximately 7,728 of the 14,547 acres are located in the Middleground from main roads, while approximately 4,602 acres are located in the Background. Only 1,611 acres are located in the Foreground of main roads. Sixty-nine percent of the North Cave Hills is classified as Typical while 28 percent is classified as Indistinctive. It should be noted that none of North Cave Hills is classified as Distinctive.

Figure 3.4-1. Visual appearance of Existing Oil and Gas Facilities within North Cave Hills Unit.



South Cave Hills

The South Cave Hills unit (8,876 acres) is located south of the North Cave Hills unit and is the closest to the town of Buffalo, SD (approximately 12 miles to the south). Character types include Hardwood Draws, Ponderosa Benches, Upland and Rolling Grassland, Rimrock and Rimrock Breaks. Figure 3.4-3 provides an example of most of the Character Types typical of the South Cave Hills unit.

There are currently 1,623 acres of existing oil and gas leases within South Cave Hills, along the southern border. There are currently two existing wells within the boundaries of these leasing areas. One of these wells is located within Management Area B (Rangeland) and is within the Middleground viewshed. The other well is not located on National Forest System (NFS) lands.

There are several Management Areas within the South Cave Hills unit as demonstrated in Table 3.4-5 and Figure 3.4-4 in the accompanying map packet.

Approximately 5,317 acres of the South Cave Hills unit are located in the Middleground when viewed from main roads while approximately 2,138 acres are located in the Background. Only 727 acres are located in the Foreground when viewed from main roads. Fifty-six percent of the South Cave Hills unit is classified as Typical while 38 percent is classified as Indistinctive. None of this unit is classified as Distinctive.

Table 3.4-5. Management Areas, Acres, and Prescribed VQOs in the South Cave Hills

Management Area	Acres	Prescribed Visual Quality Objectives (VQOs)
B – Range	6,844	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape. The VQO as assigned to the areas or as determined through the environmental analysis will be met by the development activities, subject to valid existing rights.
C – Rimrock	1,167	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape.
M – Riparian	88	VQOs will be Retention and Partial Retention. The natural-appearing landscape will remain dominant and most management activities will not be evident.
N – Woody Draws	266	VQO of Retention will be met in this area except where crossed by roads.

Source: Source: USFS 1987, pages 45, 50, 80, and 83.

Figure 3.4-3. Typical Character Types within the South Cave Hills Unit.



Slim Buttes

The Slim Buttes unit (46,972 acres) is located approximately 15 miles east of the town of Buffalo, SD. It runs north/south for approximately 25 miles and east/west for approximately 5 to 20 miles. The Castles National Natural Landmark is located within this unit but will be addressed in Section 3.16. The Character Types in this area include Hardwood Draws, Ponderosa Benches, Upland and Rolling Grassland, Rimrock and Rimrock Breaks. Figure 3.4-5 provides an example of most of the Character Types typical of the Slim Buttes unit.

There are no existing oil and gas leasing areas within the Slim Buttes unit. There are several Management Area designations within the Slim Buttes unit as shown in Table 3.4-6 and Figure 3.4-6 in the accompanying map packet.

Approximately 7,125 acres of the Slim Buttes unit are located in the Foreground, while 21,032 acres are located in the Middleground and 11,279 acres are located in the Background when viewed from main roads and developed areas. Approximately 3,850 acres are not seen in these main viewsheds. There are 452 acres classified as Distinctive within the Slim Buttes unit, while 36,921 acres are classified as Typical and 6,200 acres are classified as Indistinctive.

Table 3.4-6. Management Areas, Acres, and Prescribed VQOs in the Slim Buttes

Management Area	Acres	Prescribed Visual Quality Objectives (VQOs)
B – Range	33,599	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape. The VQO as assigned to the areas or as determined through the environmental analysis will be met by the development activities, subject to valid existing rights.
C – Rimrock	4,669	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape.
D – Wildlife/Fish	927	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed and implemented to blend with the natural landscape.
F – Developed Recreation	119	VQOs in the foreground viewing area from a developed site or along an access corridor will be either Retention or Partial Retention. The Existing Visual Condition (EVC) will not drop below the current situation, and in any circumstances in which the EVC is in class 4, 5, or 6, rehabilitation will take place.
L – Research Natural Areas (RNAs)	117	The VQO will be Preservation.
M – Riparian	172	VQOs will be Retention and Partial Retention. The natural-appearing landscape will remain dominant and most management activities will not be evident.
N – Woody Draws	3,118	VQO of Retention will be met in this area except where crossed by roads.
O – National Natural Landmark	849	The VQO is Retention. The landscape may be modified to facilitate public use and enjoyment of the area.
P – Administrative Site	3	The VQO will not exceed Modification.

Source: USFS 1987, pages 45, 50, 53, 61, 78, 80, 83, 86, and 88.

Figure 3.4-5. Typical Character Types within the Slim Buttes Unit.

West Short Pines

The West Short Pines unit (1,263 acres) is located approximately 10 miles south of Camp Crook, SD. It is a small area with several Rimrock area Character Types as well as Woody Draws, Upland Grassland, and Ponderosa Benches. There are no existing leases within this unit. Table 3.4-7 outlines the existing Management Areas contained within the West Short Pines unit. These Management Areas are shown on in the accompanying map packet 3.4-7.

Table 3.4-7. Management Areas, Acres, and Prescribed VQOs in the West Short Pines

Management Area	Acres	Prescribed Visual Quality Objectives (VQOs)
C – Rimrock	86	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape.
D – Wildlife/Fish	964	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed and implemented to blend with the natural landscape.
M – Riparian	4	VQOs will be Retention and Partial Retention. The natural-appearing landscape will remain dominant and most management activities will not be evident.
N – Woody Draws	12	VQO of Retention will be met in this area except where crossed by roads.

Source: USFS 1987, pages 50, 53, 80, and 83.

Approximately 271 acres are located in the Foreground, while the bulk of acres (568) are located in the Middleground and 226 are located in the Background. Seventy-nine percent of the landscape is classified as Typical while the remaining 13 percent is classified as Indistinctive. None of the viewsheds within this unit are classified as Distinctive.

East Short Pines

The East Short Pines unit (6,147 acres) is located approximately 20 miles south and 5 miles east of Buffalo, SD. It is a relatively small unit with several Character Types including Hardwood Draws, Ponderosa Benches, Upland Grassland Rimrock, and Rimrock Breaks. Figure 3.4-8 provides an example of most of the Character Types typical of the East Short Pines unit.

There are currently no existing oil and gas leases within the East Short Pines unit. There are several designated Management Areas as indicated in Table 3.4-8.

Figure 3.4-8. Visual Character Types within East Short Pines.



Approximately 1,295 acres are located in the Foreground while 4,123 acres are designated Middleground and 656 acres are designated as Background. Of the total 6,147 acres, 90 percent are classified as Typical. The remaining nine percent are classified as Indistinctive. None of this unit is classified as Distinctive.

Table 3.4-8. Management Areas, Acres, and Prescribed VQOs in the East Short Pines

Management Area	Acres	Prescribed Visual Quality Objectives (VQOs)
C – Rimrock	1,199	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape.
D – Wildlife/Fish	4,705	VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed and implemented to blend with the natural landscape.
M – Riparian	8	VQOs will be Retention and Partial Retention. The natural-appearing landscape will remain dominant and most management activities will not be evident.
N – Woody Draws	163	VQO of Retention will be met in this area except where crossed by roads.

Source: Source: USFS 1987, pages 50, 53, 80, and 83.

Surrounding Scenic Area

The surrounding area is similar to the landscapes within the proposed units and includes rural grasslands, ponderosa benches, and rimrock. Additionally, ranching and farming take place on lands outside of the proposed units. These other lands are managed by the BLM, Harding County, the State of South Dakota, or held in private ownership. Some oil and gas leasing takes place on these lands. Management practices vary between owners and agencies.

3.4.2 ENVIRONMENTAL CONSEQUENCES

This section documents projections of scenic impacts of implementing the various alternative leasing scenarios described in Chapter 2 within the affected environment describe above. The projections were made using the Reasonably Foreseeable Development (RFD) scenarios for each alternative and the landscape sensitivity analysis process described above.

3.4.2.1 Types of Scenic Effects

Loss of natural-appearing landscapes and loss of visual quality would be the primary scenic effects associated with oil and gas leasing activities. The amount of loss depends on the visual absorption capability of the landscape, the context and intensity of the proposed activities, and existing scenic conditions.

Scenic impact is related to the size of the proposed activity and its resultant contrast in form, line, color, and texture of its environmental setting. Losses of scenic quality would be expected to be greatest in the exploration, development, and production stages, particularly where new roads, drill pads, structures, and other surface disturbance activities would be located within landscapes having low visual absorption capability.

Oil and gas exploration and development could potentially result in direct site effects and indirect effects as seen from sensitive viewpoints (e.g., recreation sites, roads, and trails) and cause substantial change in scenic conditions. Substantial scenic effects could occur where strong visual contrasts could be perceived as human-caused, introduced, unnatural forms, lines, colors,

or textures in the landscape. These effects might occur in the foreground, middleground, or background viewing distance zones.

Oil and gas exploration and development activities could result in adverse effects wherever visually contrasting elements or modifications would be introduced in the characteristic landscape. Visually contrasting elements could include roads, drill pads, storage tanks, utility lines, and other facilities, as well as changes to landforms and vegetation patterns that could result from clearing and grading sites for these facilities. Essentially, any change to the form, line, color, and texture elements of the existing landscape could cause visual contrast. The introduction of visually contrasting elements or modifications of scale into the existing landscape by oil and gas activity could potentially alter the scenic quality of the area and/or impact views from sensitive viewpoints.

Drilling activities typically result in the most evident visual contrasts, particularly in areas that are largely undisturbed. However, effects from exploration activities would usually be short-term. Following the exploratory phase, drilling equipment is removed and the area reclaimed, mitigating most effects. In the case of a discovery, oil and gas activities could move into the development and production phases, which typically could result in long-term scenic effects that could vary in magnitude. Scenic effects can be reduced by siting facilities to take advantage of terrain and vegetation to screen activities from views. Re-grading and rehabilitation of roads and the use of non-contrasting colors on structures can help minimize scenic effects. Such mitigation measures would be implemented through the Forest Service's Standard Lease Terms.

Exploratory drilling may result in scenic effects where this activity is visible in the foreground from sensitive viewpoints, particularly in previously undisturbed landscapes. The presence of equipment potentially could be noticeable for two to three months. Roads could be noticed for several years. If no discovery is made, equipment would be removed and the area reclaimed.

Field development visible in the foreground from sensitive viewpoints typically creates strong contrasts that could result in substantial viewer effects. Where a field development would be seen in middleground and background views, visual contrasts could range from strong-moderate to moderate-weak, depending upon the visual absorption capability of the landscape.

Oil and gas activities that result in strong visual contrasts in the foreground or middleground distance zones would tend to be dominant in the landscape and be evident to casual forest observers, and would not meet the intent of either Retention or Partial Retention VQOs. Strong visual contrasts in seldom-seen areas that degrade highly scenic landscapes (Variety Class A) also would not meet Retention or Partial Retention VQOs.

The following seven conditions summarize the typical scenic effects that result from oil and gas exploration and development.

- Above-ground structures located on skyline ridges and within broad, flat areas with low vegetation screening usually can be seen in silhouette against the sky. These structures can become visually dominant in foreground and middleground distances, and may dominate at background distances.

- Roads, pipelines, and powerlines produce linear patterns in the landscape. All three of these linear features can cause removal of natural vegetation. Roads also could cause substantial landform alterations on steeper slopes. Pipelines often are arranged in straight lines and at right angles to the contours, thereby interrupting natural vegetative patterns and/or negating natural vegetative screening potentials. On steeper slopes, roads are usually located parallel or at shallow angles to the contours, thereby potentially receiving screening from natural vegetation. If vegetation is taller than cut-and-fill slopes, the road may be screened from view. However, if vegetation is shorter than cut-and-fill slopes, the road could contrast with the landscape.
- On skyline ridges, all-wheel-drive (AWD) roads and drill pads one-half acre or less usually can remain subordinate to the natural landscape. Graded roads on steep slopes and drill pads larger than one-half acre would be likely to result in visible alterations to these landforms. Clearing of vegetation on skyline ridges may be noticeable.
- Structures, drill pads, and roads can be visually dominant in barren areas, grasslands, or brushlands, due to the lack of natural screening.
- Where the viewer is above the surrounding landscape, such as on a ridge top trail or road, oil and gas developments could be more visually dominant because the viewing position could negate effective screening.
- Oil and gas activities in foreground distance zones (less than one-half mile) could have more visible details, and therefore would be of greater visual impact.

3.4.2.2 Results of the Scenic Effects Analysis

This section describes the potential effects of the alternative leasing scenarios on the scenic environment of the Sioux Ranger District, considered in detail and described in Chapter 2.

Alternative 1 - No Action, No New Leases

Under the No Action Alternative scenario, oil and gas activities could only occur within existing lease areas. Existing leases are located in the North Cave Hills and South Cave Hills. The existing lease boundaries are shown on the maps in the accompanying map packet. Only the current lease terms and stipulations can be applied to existing leases. Additional oil and gas exploration and development in the existing lease areas could result in additional effects on scenic resources.

Only North Cave Hills and South Cave Hills land units have existing leases. The RFD projects that these two land units would experience additional development on the existing leases that could result in five new well pads and 0.7 mile of new road, which could increase the visibility and intensity of effects.

North Cave Hills—Under the No Action Alternative, no new leases would be issued for the North Cave Hills unit. Additional oil and gas activities could still occur within the existing lease areas (2,784 acres). Two new wells could be built under existing leases. These two wells would be located in an area designated as Middleground within MA–E Minerals Management, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest

Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities. Additional roads (0.3 mile) to both of the projected wells would be visible within areas designated as Foreground and Middleground, respectively. New wells and roads would affect approximately 10 acres of the total 14,547 acres.

Wells can be relocated within 656 feet (200 meters) of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. Additionally, new facilities and wells will be painted colors that blend in with the surrounding landscape. Under current leases, effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No irreversible, cumulative or long-term effects would be expected.

South Cave Hills—The location of projected wells that could be built under this alternative is shown on Figure 2.02 in the accompanying map packet. Two of the projected wells would be located in an area designated as Middleground within MA–B Range, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities. The third well would be located in an area designated as Background and within MA–B Range. Approximately 15 acres (including access roads of 0.4 mile) of the existing 1,623 acres would be disturbed.

Wells can be relocated within 656 feet (200 meters) of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. Additionally, new facilities and wells will be painted colors that blend in with the surrounding landscape. Under current leases, effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No irreversible, cumulative, or long-term effects would be expected.

Slim Buttes—There are no existing leases on this unit currently.

West Short Pines—The West Short Pines unit would not be considered for new oil and gas leasing activities under the No Action Alternative since existing leases have expired.

East Short Pines—There are no existing leases on this unit currently.

Surrounding Scenic Area—The BLM estimates lands may be leased for up to 150 new oil and gas wells within neighboring Bowman County (approximately 15 to 20 miles away) (personal communication between Mike Nash, BLM North Dakota Field Office, and Wendy Hill, Foster Wheeler Environmental, September 25, 2002.) This has the potential to create cumulative visual impacts; however, due to the mitigation measures, vastness of the terrain, and the lack of existing development, the combined effects will be insignificant.

Direct Effects

Under the No Action Alternative, five new wells could be constructed and 0.7 mile of new road could be built to access these new wells. Initial land disturbance would be 28.5 acres, and 25 acres would be disturbed over the long-term for the new wells. Further direct impacts and compliance with the Forest Plan will be determined at the time of site-specific project implementation. Under current leases, effects could occur but would likely not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No irreversible effects would be expected.

Indirect Effects

Indirect effects are addressed under *Cumulative Effects*.

Irreversible Effects

The temporary effects during construction represent a short-term (two to six months), direct irretrievable effect to scenic resources for the newly disturbed acres. The long-term effects to scenery during the operation and maintenance phase also represent direct, irretrievable effects to scenic resources.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect scenic resources. No activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create direct cumulative effects to scenic resources.

Harding County has just completed the Cave Hills road improvement project. No other projects by the County are planned within the oil and gas leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the exact amount of activity on State lands in the project area that would require permits through their office, but not many permit applications are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects are expected as a result of these projects.

The State Lands Commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users regarding this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects approximately 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and into Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from the No Action Alternative in addition to these other activities.

Alternative 2 - Lease with Forest Plan Stipulations

The Alternative 2 scenarios include the activities that could be expected to take place under the No Action Alternative. Table 3.4-9 shows the number of new wells and acres of land that could be disturbed in each unit.

North Cave Hills—A total of 12 wells are projected under this alternative. Table 3.4-9 shows the total area that would be disturbed (60 acres or 0.41 percent of the unit) and the area that would be disturbed in each visual resources category. All of the projected wells would be located in MA–E Minerals Management, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

An additional 1.4 mile of road would be projected in the Middleground and Background and 0.2 miles of road would be located in the Foreground. The wells would be spaced from one to four miles apart and would represent a small percentage of the viewsheds.

As under the No Action Alternative, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen on the horizon from below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and natural re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative.

Table 3.4-9. Alternative 2 Projected Wells and Resulting Disturbed Acres*

Unit	Total Acres	Number of Projected New Wells	Projected Acres of Disturbed Land (including roads)			Projected Disturbed Land (% of Total Land Area)	Projected Miles of Road	
			Total*	Fore-ground	Middle-ground			Back-ground
North Cave Hills	14,547	12	60	5 (1 well)	30 (6 wells)	25 (5 wells)	0.41%	1.8
South Cave Hills	8,876	10	50	5 (1 well)	25 (5 wells)	10 (2 wells)	0.56%	2.6
Slim Buttes	46,972	3	15	5 (1 well)	10 (2 wells)	0	0.03%	0.3
West Short Pines	1,264	2	10	5 (1 well)	5 (1 well)	0	0.79%	0.3
East Short Pines	6,147	1	5	0	5 (1 well)	0	0.08%	0.1
Total	77,805	28	140	20 (4 wells)	60 (12 wells)	35 (7 wells)	0.18%	5.1

*Assumes an average of 5.0 acres of disturbed area per well for the long-term.

South Cave Hills—A total of 10 new wells are projected under this alternative. Table 3.4-9 shows the approximate area that would be disturbed (50 acres or 0.56 percent of the unit) and the area that would be disturbed in each visual resources category. Three of the wells have been addressed under the No Action Alternative. Some or all of the other seven wells would either be located off of NFS lands or would be located within MA–B Range, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

If located per the RFD, one would be located in the Foreground, five would be located in Middleground, two would be located in the Background, one would be located in an undesignated area, and one is projected to be located off-Forest. An additional 0.1 mile of road would be built in the foreground, 0.6 mile of road would be built in the Middleground, and 0.4 mile of road would be built in the background under the Reasonably Foreseeable Development Scenario. The wells would be spaced from three to six miles apart and the disturbed area would represent a small percentage of the viewsheds.

As under the No Action Alternative, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative.

Slim Buttes—Three wells are projected under this alternative. Table 3.4-9 shows the total area that would be disturbed (15 acres or 0.03 percent of the unit) and the area that would be disturbed

in each visual resources category. Some or all of the three wells would either be located off of NFS lands or would be located within MA–B Range, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

If located per the RFD, one of the wells would be located in the Foreground and two would be located in Middleground. An additional 0.3 mile of road would be built. The wells would be spaced from 3 to 15 miles apart and would represent a small percentage of the viewsheds.

As under the No Action Alternative, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative, or long-term effects would be expected under this alternative.

West Short Pines—Two wells are projected under this alternative. Table 3.4-9 shows the total area that would be disturbed (10 acres or 0.79 percent of the unit) and the area that would be disturbed in each visual resources category. The two wells would be located within MA–D Wildlife/Fish, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

One of these wells would be located in the Foreground and one would be located in the Middleground. An additional 0.3 mile of road would be located in the Foreground. The wells would be spaced approximately seven miles apart and would represent a small percentage of the viewsheds.

As under the No Action Alternative, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative.

East Short Pines—One well is projected under this alternative. Table 3.4-9 shows the total area that would be disturbed (5 acres or 0.08 percent of the unit) and the area that would be disturbed in each visual resources category. The well would be located within MA–D Wildlife/Fish, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest

Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

This well would be located in the Middleground. An additional 0.1 mile of road would be located in the Middleground. The well would represent a small percentage of the viewsheds.

As under the No Action Alternative, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative.

Direct Effects

Under Alternative 2, 28 new wells would be constructed and 5.1 miles of new road would be built to access these new wells. Initially, 159.6 acres of land would be disturbed and 140 acres would be disturbed over the long-term for the new wells. A Lease Notice would require that: (1) lessees must obtain USFS approval of a scenic analysis; and (2) the scenic analysis must be approved by a specialist acceptable to the USFS before any activities occur that may alter the scenic environment. Effects could occur but would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and re-vegetation has taken place. The temporary effects during construction represent a short-term (10 to 28 months), direct irretrievable effect to scenic resources for the newly disturbed acres. The long-term effects to scenery during the maintenance phase also represent direct, irretrievable effects to scenic resources for the newly disturbed acres.

Indirect Effects

Indirect effects are addressed under *Cumulative Effects*.

Irreversible Effects

No irreversible effects would be expected under the Alternative 2 leasing scenario.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

The cumulative effects would be the same as under the No Action Alternative. No substantial cumulative impacts would be expected to the surrounding scenic area under Alternative 2.

**Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources
(Preferred Alternative)**

Alternative 3 includes all of the stipulations included in Alternative 2. Under the current Forest Plan, lessees are required to obtain USFS approval of a scenic analysis per the Scenery Management System, and the scenic analysis must be approved by a specialist acceptable to the USFS Regional Landscape Architect before any activities occur that may alter the scenic environment.

The Alternative 3 scenarios include the activities that could be expected to take place under the No Action Alternative. Table 3.4-10 shows the number of new wells and acres of land that could be disturbed in each unit.

Table 3.4-10. Alternative 3, Projected Wells and Resulting Disturbed Acres*

Unit	Total Acres	Number of Projected New Wells	Projected Acres of Disturbed Land (including roads)			Projected Disturbed Land (% of Total Land Area)	Projected Miles of Road	
			Total*	Fore-ground	Middle-ground			Back-ground
North Cave Hills	14,547	5	25	5 (1 well)	15 (3 wells)	15 (3 wells)	0.17%	0.8
South Cave Hills	8,876	9	45	5 (1 well)	20 (4 wells)	15 (3 wells)	0.51%	3.3
Slim Buttes	46,972	2	10	5 (1 well)	5 (1 wells)	0	0.02%	0.2
West Short Pines	1,264	2	10	5 (1 well)	5 (1 well)	0	0.79%	0.3
East Short Pines	6,147	1	5	0	5 (1 well)	0	0.08%	0.0
Total	77,805	19	95	20 (4 wells)	50 (10 wells)	30 (6 wells)	0.18%	4.6

* Assumes an average of 5.0 acres of disturbed area per well for the long-term.

North Cave Hills—A total of five wells are projected under this alternative. Table 3.4-10 shows the total area that would be disturbed (25 acres or 0.17 percent of the unit) and the area that would be disturbed in each visual resources category. Some or all of the projected wells would either be located off of NFS lands or would be located in MA-E Minerals Management, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

An additional 0.1 miles of road would be located in the Background. The wells would be spaced from one to four miles apart and would represent a small percentage of the viewsheds.

As under Alternatives 1 and 2, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen on the horizon from below. In addition, new facilities and

wells will be painted colors that blend in with the surrounding landscape. Effects would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and natural re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative in this unit.

South Cave Hills—A total of nine wells are projected under this alternative. Table 3.4-10 shows the total area that would be disturbed (45 acres or 0.51 percent of the unit) and the area that would be disturbed in each visual resources category. Three of the wells have been addressed under the No Action Alternative. Some or all of the other six wells would either be located off of NFS lands or would potentially be located within MA–B Range, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

Of these six additional projected wells, if located on NFS lands, one would be located in the Foreground, two would be located in the Middleground, two would be located in the Background, and one would be located in an undesignated area. An additional 0.1 mile of road could be located in the Foreground, 0.7 mile of road could be located in the Middleground, and 0.1 mile could be located in the Background. The wells would be spaced from three to six miles apart and would represent a small percentage of the viewsheds.

As under the other alternatives, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and natural re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative in this unit.

Slim Buttes—Two wells are projected under this alternative. Table 3.4-10 shows the total area that would be disturbed (10 acres or 0.02 percent of the unit) and the area that would be disturbed in each visual resources category. The two wells, if located on NFS lands, would be located within MA–B Range and MA–C Rimrock, which allow for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

One of the wells would be located in the Foreground and one would be located in the Middleground. An additional 0.2 miles of road would be constructed. The wells would be spaced approximately 3 to 15 miles apart and would represent a small percentage of the viewsheds.

As under the other alternatives, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and natural re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative, or long-term effects would be expected under this alternative.

West Short Pines—The same number of wells (two), are projected under Alternative 3 as under the other two alternatives. Table 3.4-10 shows the total area that would be disturbed (10 acres or 0.79 percent of the unit) and the area that would be disturbed in each visual resources category. The two wells, if located on NFS lands, would be located within MA–D Wildlife/Fish, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities.

One of these wells would be located in the Foreground and one would be located in the Middleground. An additional 0.3 mile of road would be constructed in the Foreground. The wells would be spaced approximately seven miles apart and would represent a small percentage of the viewsheds.

As under the other alternatives, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects would not be substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and natural re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative.

East Short Pines—The same number of wells (one), are projected under Alternative 3 as under the other two alternatives. Table 3.4-10 shows the total area that would be disturbed (5 acres or 0.08 percent of the unit) and the area that would be disturbed in each visual resources category. This well, if located on NFS lands, would be located within MA–D Wildlife/Fish, which allows for a VQO of Retention, Partial Retention, or Modification. Pursuant to current Forest Service requirements, VQOs must be determined prior to implementation of project-specific oil and gas leasing activities. This well would be located in the Middleground. The well would represent a small percentage of the viewsheds.

As under the other alternatives, wells can be relocated within 600 feet of the originally projected location in order to mitigate visual impacts. New facilities will not be located within 100 feet of ridgelines so that they cannot be seen from viewers below. In addition, new facilities and wells will be painted colors that blend in with the surrounding landscape. Effects would not be

substantial due to the small number of acres, mindful locating of facilities, and use of appropriate paint color. Existing and new wells within existing and projected leases constitute irretrievable short-term effects until the wells and access roads are decommissioned and natural re-vegetation has taken place. No substantial lost opportunity, irreversible, cumulative or long-term effects would be expected under this alternative.

Direct Effects

Under Alternative 3, 19 new wells would be constructed and approximately 4.6 miles of new road would be built to access these new wells. Initially, 108.3 acres of land would be disturbed, and 95 acres would be disturbed over the long-term for the new wells. A Lease Notice would require that: (1) lessees must obtain USFS approval of a scenic analysis; and (2) the scenic analysis must be approved by a specialist acceptable to the USFS before any activities occur that may alter the scenic environment. Further direct impacts and compliance with the Forest Plan will be determined at the time of site-specific project implementation. The temporary effects during construction represent a short-term (8 to 23 months), direct, irretrievable effect to scenic resources for the newly disturbed acres. The long-term effects to scenery during the maintenance phase also represents direct, irretrievable effects to scenic resources for the newly disturbed acres.

Indirect Effects

Indirect effects are addressed under *Cumulative Effects*.

Irreversible Effects

No irreversible effects would be expected under the Alternative 3.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

The cumulative effects would be the same as under the other alternatives. No substantial cumulative impacts would be expected to the surrounding scenic area under Alternative 3.

Alternative 3 Stipulations

The following stipulations shall be applied to the Scenery Management Analysis performed at the time of project-specific leasing applications in order to assure Forest VQOs are met:

CSU: When the project-specific scenic analysis is conducted, if the VQO is determined to be Partial Retention or Modification, the lessee must submit visual simulations with plans for Forest Service approval demonstrating that all structures will be visually subordinate to the surrounding landscape.

NSO: When the project-specific scenic analysis is conducted, if the VQO is determined to be Retention, the scenic condition must be “unnoticed alterations,” and the proposed offending structure must be relocated or abandoned unless a Forest Plan Amendment is implemented.

3.5 ISSUE 5: ECONOMIC RESOURCES

3.5.1 AFFECTED ENVIRONMENT

3.5.1.1 Study Area

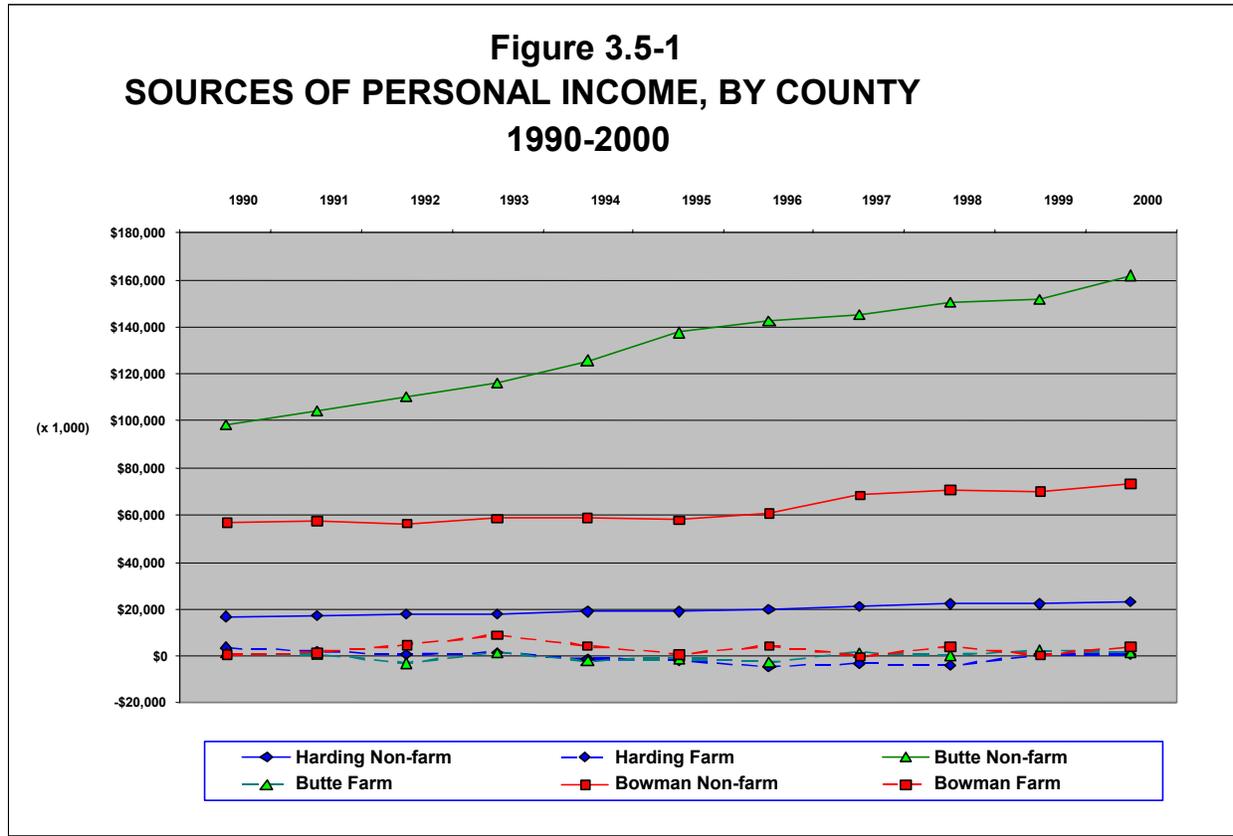
All the National Forest System lands in the project area are located in Harding County, South Dakota. According to the Bureau of Economic Analysis (BEA) classification, Harding County lies within the Rapid City Economic Area (US Dept. of Commerce 1995). The BEA defines economic areas to include one or more centers of economic activity (nodes) and those surrounding counties that have an economic relationship with the nodes. The determination of whether an economic relationship exists between counties was based, in large part, upon 1990 Census data on commuting patterns.

The economic effects of decisions made through the EIS process will extend beyond Harding County. Harding County is one of the least populated counties in the state, and consequently the retail trade and service sectors are small compared to those in more populated areas. Depending upon where in the county they live and what they are buying, Harding County residents may travel to towns like Bowman (Bowman County, North Dakota) or Belle Fourche (Butte County, South Dakota) to purchase consumer goods and services. The effects of an income change in Harding County will therefore be felt in those neighboring counties.

Furthermore, the labor, equipment, and services required to conduct oil and gas exploration, development, and production activities within the project boundaries are likely to be obtained from other areas having established businesses serving the oil and gas industry (e.g., Bowman County, North Dakota). Even though Bowman County is in the Bismarck Economic Area rather than the Rapid City Economic Area, there still appears to be a strong enough economic relationship between Harding and Bowman Counties to warrant including the latter in the impact area. Thus, for purposes of this EIS, the economic impact area is defined to include Bowman County, North Dakota, and Butte and Harding Counties, South Dakota. Due to issues that have been raised by Harding County residents, portions of the economic analysis are focused on that county.

3.5.1.2 Sources of Income and Employment

Farm income is less important in Bowman and Butte Counties than in Harding, and the percentage of farmland in Bowman County, while high, is lower than that of Harding County. Although aggregate crop sales are a somewhat bigger factor in Bowman and Butte Counties' gross farming sales, livestock and related products still make up a majority of the cash receipts from the sale of agricultural products. Among crops, wheat is the most important in Bowman County, in contrast to Butte County, where most of the crop receipts are generated from the sale of hay, silage, and field seeds. For both counties, like Harding, net earnings of the farming sector have been depressed for many years.



The government sector accounts for the largest share of non-farm earnings in Harding County (31 percent in 2000), with the county public school system making up the principal component as well as being the largest single employer in the county. (US Dept of Commerce 2002.) Given the low population of the county, it is not surprising that some sectors are absent or underrepresented. Manufacturing, for example, accounted for less than 1 percent of 2000 non-farm earnings, while agricultural services/forestry/fishing accounted for only 2.5 percent, and mining (mainly oil and gas production) generated approximately 1.5 percent. Construction activities, which include oil and gas field maintenance activities and exploration and development drilling in addition to civil construction, accounted for 7.2 percent of non-farm earnings. Besides government, the largest sectors in terms of non-farm income were services (25 percent), public utilities and transportation (20 percent), and wholesale and retail trade (12 percent).

In Butte County, the largest share of 2000 non-farm earnings was attributable to retail and wholesale trade (24 percent), with the next largest being government (20 percent) and services (21 percent). (US Dept of Commerce 2002.) Mining, including oil and gas production, accounted for 6.4 percent of the county's non-farm earnings, while construction generated 8.5 percent. In Bowman County, the services sector was largest with 27 percent of total non-farm earnings, followed by wholesale/retail trade with 26 percent. Next largest was government with 16 percent, while mining and construction accounted for, respectively, 6.3 percent and 8.7 percent of earnings.

3.5.1.3 Economic Resiliency

Economic resiliency refers to the ability of an area's economy (e.g., community, county, or region) to adapt to changes or shocks. A high degree of economic resiliency implies that changes to one sector are offset elsewhere in the economy. Economic diversity is one measure of economic resiliency. Using employment data for various years, the Forest Service (1993) computed economic diversity indices for all U.S. counties. The indices have been normalized to range between zero and one. An index of zero indicates that all economic activity is concentrated in just one industry and there is no diversity, while an index of one means every industry's share of total employment is equal. Indices were computed at the one-digit (i.e., 9 major industry divisions), two-digit (approximately 50 divisions), and four-digit (more than 500 industry divisions) Standard Industrial Classification (SIC) code levels. As might be expected, the economic diversity index increases at higher levels of industry aggregation. The indices at a particular SIC aggregation level have generally been rising over time, indicating that U.S. counties are becoming more diverse.

The economic diversity indices for the three counties in the impact area were higher in 1993 than in 1977, the first year for which the indices were computed. Thus, the impact area can be characterized as having become more economically diverse over the period surveyed. The relative change in the index was not uniform for the three counties. Butte County's economic diversity index showed the most growth over the 16-year period, increasing from 0.73 in 1977 to 0.89 in 1993. The 1993 1-digit SIC level index for Harding County, while 18 percent above the 1977 level, was essentially the same as in 1985. For comparison purposes, the economic diversity index (at the one-digit SIC level) for the U.S. was 0.85 in 1993.³

3.5.1.4 Fiscal Setting

According to the 1997 Census of Governments, during Fiscal Year 1996-97 (October through September) Harding County government jurisdictions took in general revenues of \$3.6 million and had direct general expenditures of \$3.5 million. Local taxes generated \$1.9 million in revenues, of which 83 percent were based on property taxes. Inter-governmental transfers from state and federal sources funded much of the balance of \$1.6 million in general revenues. The local governments employed the full-time equivalent of 83 employees. An additional 33 state-level employees were located in the county along with 34 federal civilian and military personnel (1998 data).

Oil and gas leases on federal lands in Harding County generate revenue to the federal government in the form of lease bonuses, lease rentals, and production royalties. A portion of the federal government's receipts are paid to the state. The vast majority of land in the Sioux project area is public domain land, and 50 percent of the federal oil and gas royalties from those lands are shared with the State of South Dakota and then disbursed to school districts having lands

³ A separate computation of the economic diversity index for Harding County and the USA as of 1999 was available at the four-digit SIC level of detail. Based on the more detailed (500+ individual industry divisions) breakdown of study area employment, the diversity index for Harding County was 0.469 versus 0.739 for the national economy. (Minnesota IMPLAN Group, Inc. 2002a.)

involved in the federal mineral leasing program. This share is based on the acreages of school district lands falling within the federal lands in the State, which in the case of the Harding County School District, is 12.59 percent. (Personal communication, Susan Woodmansey, SD Department of Education, November 6, 2002.) Annual production and royalties from oil and gas production on federal lands in Harding County for fiscal years 1999, 2000, and 2001 are shown in Table 3.5-1. Royalties and other mineral revenues disbursed to the state ranged from a low of \$266,931 in fiscal year (FY) 1999 to a high of \$559,510 in FY 2001 for oil and gas produced in Harding County. Harding County School District's share in FY 2001 would have been approximately \$70,000.⁴

The Forest Service manages approximately 74,000 acres of public domain land and 9 acres of acquired land in Harding County. If the acquired lands are leased or otherwise are generating earnings, generally 25 percent of the revenues from those lands would be shared with Harding County under Public Law 106-393 ("25 Percent Fund Payments"). In FY 1997, Harding County received \$6,279 under this law. (USFS 2002.) The Bureau of Land Management (BLM) also manages 165 acres of split estate land in the project area.

The BLM disburses Payments In-Lieu of Taxes (PILT) to county and state governments on behalf of the Forest Service and other federal agencies holding federal lands. The funds may be used by the state and local governments to improve schools and roads and for other purposes. The BLM's payment to South Dakota for FY 2002 totaled almost \$2.5 million, of which approximately \$1.67 million, or two-thirds, was based on Forest Service acreage. Harding County's share of these payments amounted to \$105,123 of which the portion from Forest Service land was \$74,881 (based on its holding 74,016 acres of qualified land, or 71.2 percent of the federal lands in the county). (BLM 2002.)

In total, the disbursements of oil and gas royalties and PILT payments to Harding County jurisdictions accruing from activities on federal lands are estimated to currently amount to between \$250,000 and \$300,000 per year. (POWER Engineers/RT Mott estimate based on above data.) These revenues make a modest but doubtless welcome contribution to the county's finances.

⁴ Distributions of federal mineral revenues by the State Department of Education are made twice a year (in November and May) from payments received monthly from the federal government (Minerals Management Service). The State's fiscal year runs July through June, so actual distributions will not exactly agree with the values in the table, which are based on the federal fiscal year (October through September).

Table 3.5-1. Federal Oil and Gas Production, Value, and Mineral Revenue Disbursements in South Dakota and Harding County, Fiscal Years 1999-2001

Year	Mineral	Statewide Production	Harding County Production	Statewide Royalty Value	Disbursed to State	12.59% Share to Harding County S.D. ¹
FY 1998-99	Oil	208,040 bbl	159,664 bbl	\$308,362	\$154,181	\$19,411
	Gas	342,782 mcf	342,754 mcf	\$60,278	\$30,139	\$3,795
	Other ²	--	--	\$204,112	\$102,056	\$12,849
Subtotal FY 1999		--	--	\$572,752	\$266,931	\$33,607
FY 1999-00	Oil	184,935 bbl	157,360 bbl	\$571,703	\$285,852	\$35,989
	Gas	318,725 mcf	318,725 mcf	\$80,070	\$40,035	\$5,040
	Other ²	--	--	\$473,351	\$236,676	\$29,797
Subtotal FY 2000		--	--	\$1,125,124	\$545,847	\$68,722
FY 2000-01	Oil	186,130 bbl	154,466 bbl	\$636,982	\$318,491	\$40,098
	Gas	312,521 mcf	312,521 mcf	\$134,492	\$67,246	\$8,466
	Other ²	--	--	\$347,545	\$173,773	\$21,878
Subtotal FY 2001		--	--	\$1,119,019	\$559,510	\$70,442

¹ See text for explanation of distribution.

² Other = bonus payments, rents, and other revenues.

bbl = barrels (42 US gallons)

mcf = thousand cubic feet.

Sources: MMS 2002; Personal communication, Susan Woodmansey, SD Department of Education, November 6, 2002.

3.5.2 ENVIRONMENTAL CONSEQUENCES

3.5.2.1 Overview of Economic Consequences

The direct economic effects of the Forest Service's Sioux oil and gas leasing decision *per se* are negligible because they represent administrative actions by a federal agency, the value of whose economic output is measured by the value of labor consumed in the process. The indirect effects, however, have real impacts, arising from allocations of capital, labor, and land to the finding and production of oil and gas in the Custer National Forest. These are the objectives of the leases, and it is the logistics of oil and gas exploration, development, and production that create employment and income in the project area. These are the economic effects that are being evaluated in this section of the report.

The RFD identifies five areas on Forest Service lands in Harding County where oil wells exist and/or would be drilled under various development scenarios. The economic effects of activities at any of these areas on the county would be generally the same across the county. This is because the factor that generates economic effects is money flows—wages and salaries paid to the oil field workers, sales of goods and services by local vendors to the drilling contractors and

operators, the latter's profits on operations, and taxes paid to state and local governments. Transactions associated with these actions involving local institutions—households, businesses, and local government entities—mainly take place in communities rather than at the well sites. Accordingly, the assessment of the economic consequences of the leasing program is focused on the county level of activity with particular attention being paid to evaluating the portion of the income and employment created by the program that accrues to Harding County residents and institutions.

The discussion of existing conditions in the project region (see Section 3.5.1 of Affected Environment) noted that the economic effects of the proposed action on Harding County would extend to adjacent counties, notably Butte, SD and Bowman, ND. Ideally the impact analysis would provide some numerical estimates of those external effects, but the tools of regional economic analysis are insufficiently accurate for this kind of study because of the nature of the projects and the study area. Many of the oilfield workers that would be hired for the oil and gas field development would originate from outside Harding County—probably many from Wyoming, where most of the drilling contractors are headquartered—and there is considerable uncertainty where they would stay for the duration of their jobs in view of the limited accommodations available in Harding County. Many would stay in the more populous communities within convenient commuting distance, like Belle Fourche and Bowman, which offer more living amenities, or in RVs near the job site and commute home on weekends. In this situation, the workers spend relatively little of their wages in the project area, so the local economic effects of the exploration and development (E&D) projects are diminished. The following analysis focuses on Harding County, but in reality, the projected values for income and employment stimulated by the RFD alternatives apply in good measure to the aforementioned three-county area.

3.5.2.2 Alternative 1 – No Action, No New Leases

Under the No Action alternative, the existing four producing wells in the North and South Cave Hills areas would continue producing for their remaining lives, and, hypothetically, five more wells (three producing and two injection) would be added to the two areas. The time frame for this alternative (as well as for the other two alternatives) is 15 years.⁵ This 15-year scenario is based on current forecasts for worldwide trends in energy prices, which means that the No Action alternative could take several years to play out. The RFD, in fact, postulates for all alternatives

⁵ Please note that this scenario for RFD wells is projected for analysis purposes only, and is not planned to be undertaken at any particular time in the future. As stated in the RFD Scenario, “[a] purpose of the RFDS is to provide a basis for analyzing and estimating environmental effects. Wells have been predicted in different biophysical settings throughout the Sioux RD. To the extent that the biophysical settings are the same or similar throughout the analysis area, the effects of the action(s) will be the same, or similar, if the development occurs at locations different than forecast in the RFD. Therefore, the site-specific RFD forecast can serve as the basis for leasing decisions for ‘specific lands’ throughout the area of analyzed effect, regardless of whether a specific area was, or was not, forecast to be affected in the RFD. It must be recognized that future exploration and development may not occur where predicted in the RFD.”

that wells would be drilled on the average of one or two per year.⁶ In point of fact, all of the new wells in the scenario could be drilled within a little as a single year (it typically takes a drilling rig approximately three to four weeks to complete a well to a depth of 7,000-9,000 feet, which means that upwards of 15 or more wells could be drilled from a given site; a smaller number if separate sites were involved). Prevailing market prices for oil and gas, and costs and availability of drilling equipment and workers, would actually determine the pace of exploration and development.

Although the exact timing of the scenario cannot be predicted, at some point in time developer interest would likely be manifested in a commitment to drill, in which case equipment and crews would be mobilized and deployed to the two areas. Assuming separate contractors and operations, two rigs would be employed: one to drill three wells in the North Cave Hills area, and the other to complete the two wells in the South Cave Hills area. While both operations would likely occur within a single year, it will be assumed here that as postulated in the RFD for analysis purposes, on the average, two wells will be drilled per year.

In 1999 (latest data available), the average cost of an onshore oil well in the United States was \$783,000, a gas well cost \$798,400, and a dry hole cost \$1,115,500 (US Dept of Energy 2002). Assuming an average cost per oil/injection well of \$785,000, the total annual investment cost for two new wells would amount to \$1,570,000.⁷ This is the figure that will be used to estimate the local economic effects—on an annualized basis—of the exploration and development phase of the No Action alternative on Harding County (as well as the other two alternative RFD scenarios, since the average annual drilling rate is assumed to be the same for all cases).

Addressing the longer-term impacts of crude oil production, the No Action alternative postulates that the four existing oil wells (two in North Cave Hills and two in South Cave Hills) would continue producing, and that three new wells would become producers. The scenario postulates the oil wells would produce an average of 200,000 barrels of crude oil over their lifetimes, which would cumulatively amount to 1.4 million barrels. For purposes of this impact analysis, it is necessary to separate production of the existing wells (which is part of the current baseline socioeconomic environment) from output of the projected new wells. Assuming a productive life of 15 years, that would translate into a total output of 40,000 barrels per year from the three new

⁶ The RFD states, “Predicted Rate of Drilling – The rate of drilling is primarily determined by the price of oil and gas. Discoveries of new fields can also cause the number of wells drilled in a year to increase while the field is being developed. For analysis purposes, the assumption was made that drilling would be relatively constant throughout the 15-year analysis period with one to two wells drilled per year on the Forest Service units.”

⁷ Ideally, more recent data than 1999 for the costs of drilling exploration and development wells would be used, and for South Dakota in particular. However, such data were not available within the scope of this study. The Department of Energy published a table in 1996 of the costs of drilling and equipping wells by depth interval by state, and the one for Wyoming (there was none for South Dakota) indicated costs for wells in the 10,000 to 12,499 foot range (for which recently permitted wells in Harding County involving directional horizontal drilling were registering) had costs averaging \$707,000 for oil wells, \$721,000 for gas wells, and \$440,000 for dry holes. With cost escalation to the year 1999 factored in, the Wyoming numbers would closely match those cited for the nationwide averages.

wells, for a cumulative total of 600,000 barrels over 15 years. The RFD projected an average price for crude oil in the Lower 48 states ranging from a low of \$20.70 per barrel in 2005 to a future high in 2020 of \$23.79/bbl. Assuming that the 15-year time frame for the scenario embraces a typical well life and taking the lower near-term price projection, the three new producing wells would therefore generate an average of \$828,000 worth of oil per year. This is the figure that will be used to estimate the longer-term incremental economic effects of the production phase of the No Action alternative on Harding County.

Table 3.5-2, below, presents the results of the IMPLAN economic impact modeling of the No Action scenario's exploration and development (i.e., construction) phase. Operating (i.e., production) effects will be shown in a subsequent table.

Table 3.5-2. Economic Effects of Alternative 1 on Harding County – Construction Phase

Value Parameter	Construction Phase Impacts (\$1.570 million E&D Phase: Average Annual Basis: 2 wells per year)			
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Total Output	\$1,570,000	\$187,387	\$172,374	\$1,929,761
Total Intermediate Inputs	\$1,193,930	\$89,127	\$43,527	\$1,326,584
Total Value Added	\$376,070	\$98,260	\$128,848	\$603,177
Total Labor Income	\$240,657	\$71,545	\$90,607	\$402,808
Total Other Prop. Income	\$110,819	\$21,555	\$31,173	\$163,548
Total Ind. Business Taxes	\$24,594	\$5,160	\$7,068	\$36,822
Total Jobs (Full- & Part-time)	29.1	3.2	5.1	37.3

Source: IMPLAN 2002b.

The direct effect of the E&D drilling phase is creation of a \$1.570 million average annual increase in the value of output of the county's oil and gas E&D sector (which is part of the general construction sector of the local economy) during the 15-year project planning horizon. The majority of the increased output will be accounted for by imports of E&D related goods and services from outside Harding County. The IMPLAN model indicates that intermediate inputs of raw and semi-processed goods and services directly consumed by the E&D activities would amount to \$1.19 million per year, or approximately 76 percent of the value of final E&D direct cost. This is a considerable percentage of the total value of direct output, reflecting the fact that Harding County-based businesses can supply only a relatively small portion of the equipment, supplies, and services required for oil and gas exploration and development. The difference between total direct output and direct intermediate inputs (\$376,070 per year) is called "value added," which measures the value of labor, capital, and local indirect business taxes (mainly sales and use taxes) provided by Harding County-based factors of production to the E&D activities. The largest component of value added is labor income—wages, salaries, and self-employment earnings of E&D people working in Harding County—that would amount to approximately \$240,660 per year for the No Action alternative. Profits of the E&D contractors

are projected at almost \$111 thousand, while State and local taxes accruing on direct activities would amount to an estimated \$24.6 thousand per year.

The sector's requirements for supplies of goods and services sets off a secondary stage of activity called the "indirect" effect, which is the additional business accruing to local businesses supplying goods and services to the oil and gas E&D sector. Replacing the inventories of these businesses would generate an additional \$187,387 of output per year. A third phase of activity then develops, called the "induced" effect, which comes from the consumption spending of wages, salaries, and other income earned by households, directly or indirectly, as a result of the initial direct E&D activity. The induced output would amount to \$172,374. Over the course of a year or so, the cumulative effect of the \$1.570 million in direct drilling expenditures is a 1.23 output multiplier effect, where the successive rounds of spending by the drilling contractors, their local suppliers, and the wage earners and other recipients of income stemming from the E&D activities generate a temporary expansion of the Harding County economy's output totaling \$1.93 million per year, on the average. As a result of the multiplier effect, additional personal income (labor earnings) throughout the county would increase by approximately \$403,000 per year, while employment would increase over the baseline trend by approximately 37 additional jobs per year for the duration of the scenario.

The model projects annual average direct E&D employment numbering approximately 29 full- and part-time jobs, which would last for the duration of the scenario's E&D phase. It should be noted, however, that the employment projections are based on place of work and not place of residence of the workers. It is likely that a substantial share of the drilling personnel will be from outside the county, commuting or temporarily relocating from more populous parts of the Williston Basin oil region. This observation is based on the fact that most of the drilling contractors who have recently worked wells in Harding County are based in Gillette and Upton, Wyoming (SD DENR 2002), and it is likely that they would hire many of their crew members from residents of their home communities. A consequence of this is that a considerable portion of the wages and salaries paid to the drilling crew leaks outside the local economy instead of being spent locally. As a result, the stimulative effects of the direct activity on the local economy are attenuated.

Looking at the operating results for Alternative 1, the project indicates that at an average rate of production valued at \$828,000 per year (40,000 barrels per year from the three new wells priced at \$20.70 per barrel), the value of total output in the county including the secondary gains from the indirect and induced effects would amount to more than \$1.22 million per year. Of this, local businesses and households would cumulatively create more than \$805,000 in additional local labor and capital earnings and indirect business taxes, and support 20 additional local jobs. These gains would continue for the lives of the new wells, nominally 15 years.

Table 3.5-3. Economic Effects of Alternative 1 on Harding County – Production Phase

Value Parameter	Production Phase Impacts (\$0.828 million/year Production Phase)			Total Effect
	Direct Effect	Indirect Effect	Induced Effect	
Total Output	\$828,000	\$157,096	\$241,110	\$1,226,207
Total Intermediate Inputs	\$273,638	\$90,429	\$56,293	\$420,361
Total Value Added	\$554,362	\$66,667	\$184,817	\$805,846
Total Labor Income	\$201,774	\$31,552	\$134,467	\$367,793
Total Other Prop. Income	\$296,994	\$29,019	\$41,825	\$367,837
Total Ind. Business Taxes	\$55,594	\$6,097	\$8,525	\$70,217
Total Jobs (Full- & Part-time)	10.1	2.4	7.3	19.8

Source: IMPLAN 2002b.

While positive, these gains in economic activity must be viewed in the context of the overall local economy. Total personal income in Harding County amounted to approximately \$24 million in 2000 and total employment numbered a little under 1,000. The net average annual gains in personal income and employment under the No Action alternative—approximately \$771,000 in labor income with 57 jobs (combined total effects for E&D and production on an average annual basis for 15 years)—would constitute negligible increments to the county’s economic base, particularly in view of the likely high degree of leakage of direct E&D wages and salaries earned by non-resident workers. The contribution of the investments in the new wells to the economy, while welcome, would not make much of a difference in material welfare levels. Under the No Action alternative, economic trends will likely continue in their current direction—continuing slow loss of population, an aging workforce, underdeveloped commercial and service sectors and infrastructure, and heavy dependence on agriculture and government. Harding County (with much in common with its neighbors) is essentially a frontier economy, highly dependent on income from exports of agricultural products and receipts of property-based earnings and intergovernmental transfers of support payments for its economic wherewithal.

New construction and production activities at oil and gas well sites will alter the landscape and potentially affect the quality (and economic value) of recreational activities in the lease areas. The areas are not pristine, however, and resources reflect the presence of man and his works, of which the proposed oil and gas developments are an ongoing process for which extensive mitigations are instituted to ameliorate the adverse effects on, *inter alia*, recreational values. The extent to which visitors to and users of the recreational resources may alter their behavior (and spending) cannot be precisely quantified, absent an extensive contingent valuation or other type of consumer survey, but given the sparseness, dispersed locations, and timing of the probable E&D activity relative to the extent of available land for recreational use, it seems unlikely that the overall economic impact on the county’s recreation service providers would be considerable.

As noted in Section 3.5.1, in 2001, the Harding County School District received approximately \$70,400 from its 12.59 percent share of royalties and other mineral revenues from oil and gas production on federal lands in the State. The county government also received an estimated

\$100,000 per year of payments in lieu of taxes (PILT) from the Bureau of Land Management, based on the Forest Service's fees on users of its lands. If the three new producing oil wells fulfilled the projected level and value of output, the county school district's royalties would decrease by approximately \$2,360 per year (assuming long-term prices for oil production).⁸

This level of additional payments would continue so long as production continued on the two new wells.

3.5.2.3 Alternative 2 – Lease with Forest Plan Stipulations

As described in the RFD Scenario, this proposed alternative would see the drilling of 28 new wells in the five lease areas together with the continued production of four existing oil wells. Of the 28 new wells, 13 are projected to produce crude oil while one other would produce natural gas. The remainder would be dry holes or injection wells for secondary recovery. Like the No Action alternative, Alternative 2 would extend nominally for 15 years. Theoretically, 28 wells could be drilled in one year's time if multiple drilling rigs were employed, but vagaries of the oil and gas market and fluctuations in the supply and demand for drilling equipment could extend the development period over a longer time. For purposes of projecting economic effects, per the RFD Scenario, it is assumed that two wells would be drilled in any one year over the 15-year project horizon.

As was discussed earlier for Alternative 1, completion of two wells per year would entail an investment cost of \$1,570,000. The direct, indirect, and induced effects for that outlay were tabulated in Table 3.5-2 (repeated below as Table 3.5-4), and were described in Section 3.5.2.2.

⁸ The decrease is due to the difference in prices of oil in previous years (it was approximately \$28/bbl in FY 2001) versus the projected long-term price (\$20.70/bbl). At an average rate of production of 40,000 barrels per year, the output of the three new wells under Alternative 1 would amount to 21.5 percent of the 186,130 barrels of oil produced on federal lands statewide in FY 2001 (which would include the output of the existing three wells in the North and South Caves areas). If all the existing wells on federal lands in the state continued to produce at the FY 2001 level, then the three new Alternative 1 wells would bring total oil output from federal lands statewide up to 226,130 barrels per year. At the long-run price of \$20.70 per barrel cited in Section 3.5.1.3, the combined output would be worth approximately \$4.681 million. The federal royalty of 12.5 percent would be approximately \$585,110, of which one-half would go to the federal government and one-half to South Dakota. Harding County School District's 12.59 percent share of South Dakota's share would thus be approximately \$37,740, which would represent a net decrease of approximately \$2,358 from the District's share of oil-based federal mineral revenues distributed in FY 2001 (see Table 3.12-1). In addition, as noted earlier in Section 3.5.1.3, the county school district would also receive a share of the federal royalties on gas production and other mineral revenues in the state, which if they continued at FY 2001 levels and prices, would yield a net royalty to the county school district of approximately \$33,600 per year, bringing the aggregate royalties disbursed to the county school district to approximately \$68,000 per year. Finally, the county government would receive PILT disbursements from the BLM of around \$100,000 per year.

Table 3.5-4. Economic Effects of Alternative 2 on Harding County – Construction Phase

Value Parameter	Construction Phase Impacts (\$1.570 million E&D Phase: Average Annual Basis: 2 wells per year)			
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Total Output	\$1,570,000	\$187,387	\$172,374	\$1,929,761
Total Intermediate Inputs	\$1,193,930	\$89,127	\$43,527	\$1,326,584
Total Value Added	\$376,070	\$98,260	\$128,848	\$603,177
Total Labor Income	\$240,657	\$71,545	\$90,607	\$402,808
Total Other Prop. Income	\$110,819	\$21,555	\$31,173	\$163,548
Total Ind. Business Taxes	\$24,594	\$5,160	\$7,068	\$36,822
Total Jobs (Full- & Part-time)	29.1	3.2	5.1	37.3

Source: IMPLAN 2002b.

Ultimately, 14 of the 28 new wells would be producers. Thirteen would be producing crude oil, the value of which, under the earlier assumptions of average annual output and price, would amount to \$276,000 per well, for an aggregate total of \$3,588,000 per year.⁹ The 14th well would produce natural gas, which the Forest Service believes would amount to approximately 400,000 thousand cubic feet (mcf) over its life. Assuming a 15-year life, annual production would average approximately 26,670 mcf. The base well-head price of natural gas over the longer term that underlies the leasing alternatives ranges from a low of \$2.66 per mcf in 2005 to \$3.26 per mcf in 2020. Using the 2005 value of \$2.66, a production rate of 26,667 mcf per year would be worth approximately \$70,935. Combining this figure with the one for crude oil production yields an average annual value of new oil and gas production under the Proposed Alternative of approximately \$3,659,000, which is the value that will be used for the production phase economic impact analysis. Table 3.5-5 presents the economic impact modeling results for the production phase of Alternative 2.

⁹ The RFD assumes a typical oil well will produce 200,000 barrels of crude, or 13,333.3 barrels per year over 15 years. Thirteen wells @ 13,333.3 bbls/year at \$20.70/bbl = \$3,588,000 (assuming all are in production at the same time).

Table 3.5-5. Economic Effects of Alternative 2 on Harding County – Production Phase

Value Parameter	Production Phase Impacts (\$3.659 million/year Production Phase)			
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Total Output	\$3,659,000	\$694,222	\$1,065,486	\$5,418,708
Total Intermediate Inputs	\$1,209,230	\$399,614	\$248,764	\$1,857,608
Total Value Added	\$2,449,770	\$294,608	\$816,722	\$3,561,100
Total Labor Income	\$891,654	\$139,430	\$594,222	\$1,625,306
Total Other Prop. Income	\$1,312,439	\$128,237	\$184,827	\$1,625,503
Total Ind. Business Taxes	\$245,676	\$26,945	\$37,673	\$310,294
Total Jobs (Full- & Part-time)	44.6	10.6	32.2	87.5

Source: IMPLAN 2002b.

The above table shows the economic values for RFD Scenario Alternative 2 in the 15th year of the project, once the last of the 28 new wells had been completed and the 14 producers were simultaneously producing oil and gas. Values would be lower in preceding and subsequent years as initially new wells came on line, and then after the first two wells played out (nominally in Year 15), the older wells subsequently shut down. Also, after the 15th year, there would be no further economic contribution from drilling of new wells.

In the peak year, Year 15, the total economic impact of the project on Harding County would be the sum of E&D activities (\$1.93 million total output, including direct and secondary effects) and oil and gas production (\$5.42 million), or \$7.35 million. In the first year, the combined value would be approximately \$2.29 million, increasing nominally by \$0.361 million per year between Years 2 and 15 as production ramped up with the completion of two additional wells each year. After Year 15, the value of production would decline by \$0.361 million per year as wells progressively played out (again, assuming the economic life of a well was exactly 15 years). At the peak year, the alternative scenario would be generating a maximum of \$7.35 million in gross value of economic activity in the county, of which workers' earnings would amount to \$2.03 million. A total of 125 full- and part-time jobs would be supported.

In Year 15, the State's 50 percent share of federal royalties on the additional oil and gas production from the 14 producing wells would amount to \$228,687 (based on the stated volumes and prices and the 12.5 percent royalty rate claimed by the federal government). The Harding County School District's 12.59 percent share of the State's share would amount to \$28,791. If the pre-project FY 2001 level of oil and gas production were to have continued unabated (which generated \$70,442 in FY 2001), then at this RFD scenario's peak, the county school district's federal mineral revenues allotment would have been increased by 40 percent over the baseline value.

3.5.2.4 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

This alternative would entail a somewhat smaller oil and gas exploration, development, and production effort than Alternative 2, but larger than the No Action Alternative, No. 1. Alternative 3 calls for 19 wells to be drilled (versus 28 in Alternative 2), of which 11 are expected to be producers: 10 oil and 1 gas. With three fewer new producing oil wells than in Alternative 2, total new oil production in the Forest Service lands in Harding County is projected at 2.0 million barrels over the 15-year planning horizon (versus 2.6 million barrels with Alternative 2). Gas production from the one new gas well is projected at 400,000 mcf, the same as in Alternative 2.

The parameters for the economic impact analysis for this alternative are as follows:

- Exploration and development (E&D drilling) would average two wells per year (the same as the other alternatives), thus generating an average annual rate of E&D expenditures of \$1.57 million over 15 years.
- Production at peak (15th year) with 10 oil wells and 1 gas well in operation would be worth \$2,831,000 per year (which is approximately 77 percent of the peak direct output value of oil and gas production in Alternative 2).¹⁰

The net economic effects of the E&D activities would be the same as for Alternatives 1 and 2, which were described in Sections 3.5.1.2 and 3.5.2.2. For convenience, Table 3.5-6, below, repeats the projections of economic effects of the E&D phase. As indicated, over the first 15 years, the E&D activities would support about 37 jobs per year and \$400,000 in labor income (direct, indirect, and induced), but upon completion of the scheduled wells, those jobs and associated income would terminate.

The total impacts of new oil and gas production in the peak (15th) year would amount to a \$4.19 million increase in county output over pre-project levels, of which employee compensation and proprietors' earnings (i.e., labor income) would amount to \$1.50 million. Total additional employment would number 68 full- and part-time jobs (again, these values result from action of the multiplier effect discussed earlier, i.e., the direct plus indirect plus induced effects of the peak level of oil and gas production after all producing wells come on line). Table 3.5-7 presents the IMPLAN modeling results for Alternative 3 production in its peak year.

¹⁰ Computation: 10 wells @ 13,333.3 bbl/year = 133,333 bbls crude/year @ \$20.70/bbl = \$2,760,000/year. 400,000 mcf gas over 15 years = 26,667 mcf/year @ \$2.66/mcf = \$70,934/year. Total value = \$2,830,934/year (at peak).

Table 3.5-6. Economic Effects of Alternative 3 on Harding County – Construction Phase

Value Parameter	Construction Phase Impacts (\$1.570 million E&D Phase: Average Annual Basis: 2 wells per year)			
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Total Output	\$1,570,000	\$187,387	\$172,374	\$1,929,761
Total Intermediate Inputs	\$1,193,930	\$89,127	\$43,527	\$1,326,584
Total Value Added	\$376,070	\$98,260	\$128,848	\$603,177
Total Labor Income	\$240,657	\$71,545	\$90,607	\$402,808
Total Other Prop. Income	\$110,819	\$21,555	\$31,173	\$163,548
Total Ind. Business Taxes	\$24,594	\$5,160	\$7,068	\$36,822
Total Jobs (Full- & Part-time)	29.1	3.2	5.1	37.3

Source: IMPLAN 2002b.

Table 3.5-7. Economic Effects of Alternative 3 on Harding County – Production Phase

Value Parameter	Production Phase Impacts (\$2.831 million/year Production Phase)			
	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Total Output	\$2,830,934	\$537,113	\$824,357	\$4,192,404
Total Intermediate Inputs	\$935,570	\$309,177	\$192,467	\$1,437,214
Total Value Added	\$1,895,364	\$227,935	\$631,890	\$2,755,189
Total Labor Income	\$689,864	\$107,875	\$459,742	\$1,257,481
Total Other Prop. Income	\$1,015,423	\$99,215	\$143,000	\$1,257,638
Total Ind. Business Taxes	\$190,077	\$20,847	\$29,147	\$240,071
Total Jobs (Full- & Part-time)	34.6	8.2	24.9	67.7

Source: IMPLAN 2002b.

Collectively, at the point of peak production (nominally year 15), Alternative 3 would generate the sums of output, value added, and employment in Tables 3.5-6 and -7. Similar to Alternative 2, the economic contributions to the Harding County economy under Alternative 3 would be modest at best. Annual economic contributions from Alternative 3 would be proportionately less than those under Alternative 2—approximately eight percent lower—by the difference in values of oil and gas outputs from the two alternatives (taking into account also the annualized contributions of exploration and development activities, which are the same for all alternatives).¹¹

¹¹ It should be noted that there is potentially a small amount of overlap in personnel requirements between construction (E&D) and operating (oil and gas production) activities, due to requirements for re-drilling of existing DEIS: Chapter 3 - Affected Environment/
Environmental Consequences

3.5.2.5 Cumulative Effects

Over the years, more than 300 oil and gas wells have been drilled in Harding County, and interest continues to be manifested to explore and develop petroleum resources on public and private lands. The Bureau of Land Management (BLM) SD Field Office reports that it has five E&D applications for lands around the Forest Service lease areas. (Personal communication between Russell Pigors, BLM South Dakota Field Office, and Wendy Hill, Foster Wheeler Environmental, September 25, 2002.) The BLM's North Dakota Field Office estimates that approximately 150 new wells will be drilled in neighboring Bowman County, ND (only 24 miles north of the North Cave Hills lease area) over the next three to four years. (Personal Communication between Mike Nash, BLM North Dakota Field Office, and Wendy Hill, Foster Wheeler Environmental, September 25, 2002.) South Dakota's Department of Environment and Natural Resources (DENR) reports that it expects continued development of natural gas resources in the West Short Pines area (where there are around 50 producing gas wells), and that additional well development in the North Cave Hills area is likely. (Personal Communication between Fred Steece, DENR, and Wendy Hill, Foster Wheeler Environmental, September 24, 2002.) The South Dakota Office of the Commissioner of School and Public Lands (OCSPL) held an auction of oil and gas leases on approximately 6,300 acres of State lands would in late October 2002. (OCSPL 2002.) If all leases were taken and exercised, then upwards of 39 new wells could be drilled, assuming 160-acre spacing of wells. Finally, the Forest Service's RFD for the alternative E&D scenarios assumes that the general pace of oil and gas development in the county should continue at more or less the same pace of the last 15 years, barring drastic changes in market conditions. As a point of reference, the State DENR reports that 14 oil and gas well drilling permits were issued in 2000 for Harding County, and another 11 in 2002 (some were for workovers of existing producing wells) (SD DENR 2002).

These reports indicate that oil and gas development will continue in the county with or without the Forest Service's leases. The 28 new wells covered by Alternative 2 would add to the overall level of economic activity generated by E&D activities on other lands in Harding County. Whether they would create strains on the local communities would depend on the timing of projects, but in view of past trends and conditions, it doesn't appear likely that a boom-and-bust pattern would develop and envelop the local setting. No mitigation measures are called for to regulate the pace of administration of the Forest Service leases.

A number of non-energy projects relating to grazing leases, a planned uranium mine reclamation, and a fire hazard reduction program on Forest Service lands in various parts of the Sioux oil and gas leasing study area have been identified. In addition, the South Dakota State Department of Fish and Game, Buffalo Field Office, has identified ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. (Personal communication between Brian Meyers, South Dakota Dept. of

wells and other oilfield repair and maintenance activities at the same time as new wells are being drilled. This is unlikely to materially affect the economic impact projections presented above.

Fish and Game, Buffalo Field Office, and Wendy Hill, Foster Wheeler Environmental, October 4, 2002.) These projects are unlikely to have adverse synergistic socioeconomic effects with the oil and gas leasing activities under the RFD scenarios. The main factor imposing strains on community socioeconomic relationships is an influx of transient workers placing demands on the area's housing, recreation, and other public and private services and resources. The above projects would tend to have low personnel requirements, and would extend over relatively lengthy periods of time. These characteristics ameliorate the potential for cumulative socioeconomic impacts, and no need is foreseen for mitigation measures for the RFD oil and gas leasing project alternatives.

3.6 ISSUE 6: SOCIAL RESOURCES

This section addresses the concern for potential project effects on people and what is meaningful to people about where they live. Results from the Place Assessment (Leibert 1997) show that residents of Harding County have close personal ties to the land units. Residents returning home from long-distance trips see the rock formations rising out of the prairie as a sign that they are home or getting close to home. Harding County has experienced a population decline over the last 20 years and is very sparsely populated. Although the overall population has decreased, the social organization of the community and ties among county residents remain strong.

Native Americans are a key part of the social environment in South Dakota. Please refer to sections 3.2, Cultural Resources, and 3.3, Traditional Cultural properties, for further discussions of how they are affected by this project.

3.6.1 AFFECTED ENVIRONMENT

3.6.1.1 Social Organization of Harding County South Dakota

Area Definition

The Social Resources Issue Area of Concern is Harding County, SD, which contains the five land units being considered. Due to their economic relationship, Bowman County ND and Butte County SD are included in the economic analysis (see Economic Resources Section 3.5.1.1).

Past Settlement Patterns

Over the past 700 years, multiple ethnic groups have occupied this region of the Great Plains. In 1868, western South Dakota, including the project area, was designated the Great Sioux Reservation, which was occupied by Cheyenne and Lakota tribes. Following the 1876 Battle of Little Bighorn, their holdings were reduced to the smaller reservations they now occupy along the Missouri River. The Mandan, Hidatsa, and Arikara (the Three Affiliated Tribes) coalesced in 1861 and agreed to live on the Fort Berthold Reservation in 1870. (Lowie 1935; Wood and Downer 1977; Gunnerson and Gunnerson 1971; Reher and Frison 1980; Mooney 1898; Clark 1982; Trenholm 1970; Bamforth 1988; Hoebel 1978; Grinnell 1923; McGinnis 1990; New Holy 1998.)

Project area lands were originally within the Indian Treaty lands of the Fort Laramie Treaty of 1851. At that time, the Sioux Indians were the predominant group in the area, although Crow, Cheyenne, Arapaho, and other Indians traveled through, hunted, and fought in the area. The successive forced ceding of land by the Tribes eventually opened these lands for homesteading after the Battle of Slim Buttes in 1876. The cattle raising potential of the area was evident to early settlers, and herds were trailed in as early as 1881. These herds were managed in large overlapping operations. Homesteaders followed in the late 1800s. The timbered hills soon supported a number of sawmills and a few small settlements developed. By the early 1900s, populations had reached their maximum within this area.

Numerous small towns such as Harding and Camp Crook flourished as trade centers for increasing numbers of homesteaders. However, the small size of the basic farm and ranch

operation was not suited to the climate of the country. Intensive agriculture began a steady decline, which culminated in the dry years of the 1930s. These years finally ended the intensive farming of this area. Many of the homesteads were allowed to revert to native grass and scrub cover, and were purchased by local ranchers. Ranchers were thus able to increase the size of their operations and become more economically viable. Today, many of these ranching operations are still in existence. The same cannot be said for many of the communities. The town of Buffalo, however, has continued to survive because it is the Harding County seat.

In the early 1950s, uranium was discovered in South Dakota and mining operations were implemented, bringing mineral development to the State. Mining began in Harding County in 1957. Mining was discontinued in 1967 after total production of approximately 85,000 tons of ore resulting in 270 tons of "yellow cake" (U₃O₈) in the State (Murphy n.d.).

3.6.1.2 Population

The population of Harding County was 1,343 in mid-2000, a net loss of 216 people from 1996. The county population declined approximately 24 percent between 1990 and 2000, due to a net out-migration of over 400 people, mainly due to a lack of educational and employment opportunities for high school graduates (US Dept. of Labor 2002). This represents a continuation of the population decline in Harding County that began in the 1930s. In 2000, the populations of Buffalo and Camp Crook were 380 and 56 respectively. The population of Harding County in general is aging. However, compared to South Dakota as a whole, Harding County has more of its population in the age groups 19 or under and slightly less in the age groups 65 or older due to out-migration of persons between the ages of 20 to 24. The population is 0.5 persons per square mile. Persistent hard times on the farm, outmigration of young people, and an inability to attract new industry led to population declines in 30 South Dakota counties. (USA Today 2001, ArgusLeader 2001, Rapid City Journal 2002.)

American Indian Tribes in the region include the Arikara, Cheyenne, Crow, Hidaysa and Sioux. More information regarding American Indian Tribes and Traditional Cultural Properties is provided in DEIS Sections 3.2 and 3.3.

3.6.1.3 Lifestyles

The project area is predominately rural. According to the 2000 Census, 99 percent of the land area in Harding County is comprised of farms. Residents have strong ties to the land and the small communities throughout the area. Long-time residents support traditional uses of the land and resources. They favor preservation of family ranches and business operations, and they are reluctant to endorse short-term developments that could result in life-style changes. In general, residents of small communities generally wish to retain accustomed ways of life. (Leibert 1997.)

3.6.1.4 Quality of Life and Sense of Place

A consultant hired for this project conducted five focus groups with over 25 area residents to discuss quality of life and related sense of place issues (Leibert 1997). A summary of the results of these focus groups is presented below.

Quality of life for most of the area residents who participated in the focus groups centered on low population levels that are seen to contribute to a low crime rate, lack of traffic, a feeling of safety, “having some elbow room,” clean air, a clean environment, and a slower pace of life. The quality of people that life is shared with, such as “living among people you can trust,” is also seen as very important. Attendees at one focus group indicated isolation was not perceived to be bad, unless it was forced on them by weather. In one group, it was mentioned that the relatively poor economic conditions did detract from quality of life. However, for the most part, quality of life was seen in non-economic terms and was considered in terms of things that increased enjoyment of the region rather than those things tied to making a living.

Focus group respondents agreed that public land was there for everyone, including future generations, and should be managed accordingly. However, they also felt that people affected by changes in public land use should be allowed input into the changes. They also indicated that private landowners should be allowed to do what they want with private land but that public land should be held to a higher standard. Currently, public land is seen as more natural and well maintained than private land.

Focus group participants were also asked how they felt about the five land units being assessed in the Sioux Oil and Gas Leasing EIS analysis. The importance of these areas focused on their “being natural” and “not disturbed much.” Some participants indicated these areas do not directly affect their lives very much and they do not have much time to use the areas. Nevertheless, these respondents also felt it was good to know the areas were there and that they held high sentimental and historic values. Given the high sentimental value, these participants did not see a substitute for the areas and felt the areas should be used in a wise and environmentally safe way. Participants did not want these areas developed; nor did they want to see increased traffic or an influx of people. Respondents requested that the five project areas be maintained in their current state so that the natural beauty of the areas can be enjoyed.

For many respondents, the features within the project areas serve as landmarks to indicate they are home, indicating the link between the visual environment and sense of place. Respondents indicated that project area features allow them to experience a wide variety of natural environments such as forest, mountains, streams, etc. Respondents were concerned about the areas being “discovered” because then they would “lose what was important.” Some participants focused on the hunting and fishing available in these areas, and indicated these activities provide a social outlet for residents and that the heritage and emotional ties to the area make them irreplaceable.

3.6.1.5 Forest Plan Direction

Social organization is defined in the Custer National Forest Management Plan as:

The structure of a society described in terms of institutions, community cohesion and community stability. (USFS 1987, page 144.)

A social variable is defined as:

A variable that measures social impact of Forest Service Management alternatives. Examples include population statistics, types of institutions,

and personal opinion as reflected in attitudes or as demonstrated by behavior. (USFS 1987, page 144.)

Social resources issues are not directly addressed within the management area directives in the Custer National Forest Plan. Rather, these issues are addressed indirectly through discussions of cultural resources management, visual resource management, recreation management policies, and other general management policies. (See also DEIS Sections 3.2 and 3.3, 3.4, and 3.7 and 3.8, respectively.) In addition, effects to economics also may directly affect social resource issues. See DEIS Section 3.5 for a detailed economics discussion.

3.6.2 ENVIRONMENTAL CONSEQUENCES

Potential consequences to the communities of Harding County include potential changes in the landscape and the population. Aesthetic Resources are addressed more directly in Section 3.4. Recreation Opportunities are addressed in Sections 3.7 and 3.8. Jobs for oil and gas workers would vary under each proposed alternative. Estimates of potential jobs based on construction of one well at a time are presented in Table 3.6-1.

Table 3.6-1. Estimates of Workers per Well and Construction Timeframe

Alternative	Number of Additional Wells	Number of Workers per Well ¹	Construction Timeframe ²
Alternative 1, No Action	5	10 – 15	2.5 to 7.5 months (2 to 6 weeks per well)
Alternative 2, Lease with Forest Plan Stipulations	28	10 – 15	14 to 42 months (2 to 6 weeks per well)
Alternative 3, Lease with Additional Stipulations to Protect Forest Resources	19	10 – 15	9.5 to 28.5 months (2 to 6 weeks per well)

¹A maximum of three wells would be constructed at once and would depend upon availability of drilling rigs in the region. Most likely one or two wells would be constructed simultaneously.

²This timeframe would be cut approximately in half if wells were constructed simultaneously.

3.6.2.1 Alternative 1 - No Action, No New Leases

Under the No Action alternative, social trends would continue as they currently are. While some level of satisfaction might be felt by local residents since little visual change would occur, residents would not have any economic benefits that might take place under Alternative 2. Social ties would remain strong. The likelihood of traffic congestion would remain low and the area would not likely run the risk of being “discovered.” Low population density would remain the norm and population decline would most likely continue with a net loss of approximately 200 people per five-year period.

The No Action alternative would satisfy the stated desires of participants in the Place Assessment interviews that little or no surface oil and gas development presence be visible.

Direct Effects

During oil and gas leasing activities for nine wells (five new wells) under the No Action Alternative, some insubstantial, short-term effects (from 2.5 to 7.5 months) would occur to traffic and local housing such as a potential increase in visitors (workers) at the hotel in Buffalo, SD.

This analysis assumes that no more than one to two wells would be constructed and drilled at one time. Approximately 10 to 15 people would make up the temporary work crews and truck drivers hauling supplies to each of these wells, most likely from nearby counties in North Dakota. Once construction was complete, one to three maintenance employees would be required to maintain all nine wells (four existing, five additional). Approximately 37.3 jobs would be created during construction and 19.8 permanent jobs would be created due to direct, indirect, induced and total effects (DEIS Section 3.5.2.2).

Traffic would increase during the exploration and construction phase (from 2.5 to 7.5 months) by approximately 70 truck trips and 50 car trips (workers), and then decline but remain nominally higher during well maintenance phases (10 truck trips per day throughout the Ranger District) (DEIS Section 3.18.2.1). Oil and gas would be distributed by existing underground pipelines and therefore road hazards due to increased traffic and spills would be minimized.

Transportation to favorite spots for hunting or other activities could be affected during the construction period. Once construction of new wells and roads were completed, these temporary effects would end. Long-term direct impacts due to new oil and gas leasing activities could occur to the visual environment and thus impact the perception of local residents that they live in a remote, pristine area. The arrival of new permanent workers to Harding County could also contribute directly to a sense of change in the community. Since Harding County is mainly an agricultural community, the arrival of transient oil and gas construction and production workers could potentially disrupt the local community; however, due to the low number of expected newcomers, the disruption would be expected to be minimal (personal communication, Don Haefner, Continental Oil Company, October 30, 2002).

Indirect Effects

No indirect effects would be expected under the No Action Alternative.

Irreversible Effects

No irreversible effects would be expected under the No Action Alternative.

Irretrievable Effects

During oil and gas leasing activities under the No Action Alternative, some irretrievable, short-term effects (from 2.5 to 7.5 months) would occur to traffic and local housing such as a potential increase in visitors (workers) at the hotel in Buffalo. Transportation to favorite spots for hunting or other activities could be affected during the construction period. Once construction of new wells and roads were completed, these temporary effects would end. Long-term irretrievable impacts due to new oil and gas leasing activities could occur to the visual environment and thus impact the perception of local residents that they live in a remote, pristine area. The arrival of new permanent workers to Harding County could also contribute directly to a sense of change in

the community. This analysis assumes that no more than one to two wells would be constructed and drilled at one time. Approximately 10 to 15 people would make up the temporary work crews and truck drivers hauling supplies to each of these new wells. Once construction was complete, one to three maintenance employees would be required to maintain all nine wells (four existing, five additional). These irretrievable effects would eventually be reversed once the wells were decommissioned.

Environmental Justice

Harding County's population is predominantly Caucasian (97.6%) according to the U.S. Census Bureau (2002); however, there are Native American Reservations in the vicinity. Exploration and development in the vicinity of certain American Indian sacred lands such as Ludlow Cave and the surrounding area could have a disproportionate impact to Native American cultural and social practices in the area. This alternative has the greatest likelihood of such impacts since it has the greater number of wells projected.

Cumulative Effects

Cumulative effects include effects of oil and gas leasing activities combined with other activities within Harding County.

Harding County has just completed the Cave Hills road improvement project. No other projects by the County are planned within the oil and gas leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the exact amount of activity on state lands that would require permits through their office, but not many permit applications are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects are expected as a result of these projects.

The State Land commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users regarding this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects approximately 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from the No Action Alternative in addition to these existing activities.

3.6.2.2 Alternative 2 - Lease with Forest Plan Stipulations

Direct Effects

New oil and gas leases would mean several small changes within Harding County. Approximately 10 to 30 oil and gas workers would arrive temporarily in the area, most likely from nearby counties in North Dakota. Most of the workers would be expected to commute or provide their own housing for the approximate 14- to 42-month construction period. A smaller subset would be expected to find temporary housing in Buffalo. Some activities would be temporary during exploration and well construction while some activities would continue into the future.

Oil and gas workers who already live within Harding County would be expected to work on some of the new wells both during exploration/construction and also during the operation phase. A small percentage of the total new jobs would be filled by persons relocating to Harding County. A subset of that group would be expected to bring families with them to Harding County. Exactly how many new workers would relocate is not quantifiable but based on past oil and gas leasing activity in the area and the small number (28 total) of projected new wells, it would not be expected to disrupt current community relationships. (Personal communication, Don Haefner, Continental Oil Company, October 30, 2002.) Approximately 37.3 jobs would be created during construction and 87.5 permanent jobs would be created due to direct, indirect, induced and total effects (DEIS Section 3.5.2.3).

An increase in workers to the area would bring an influx of money to the local economy both in the short-term and long-term. The 87 long-term jobs expected under Alternative 2 would not represent a substantial negative effect on the existing social structure. The jobs created in Harding County would most likely be held by workers who live within the county and those from nearby counties, who would either commute or relocate. If these workers do relocate, they would be expected to share similar values with existing Harding County residents and would have a small positive impact to the economy. Even if new people moved to the area to fill all of the expected new jobs, the population would not rise above its current level of 0.5 persons per square mile. Sense of place and community would be not expected to be substantially and negatively disrupted by a small number of newcomers to the area (personal communication, Don Haefner, Continental Oil Company, October 30, 2002).

Traffic would increase during the exploration and construction phase (from approximately 14 to 42 months) by approximately 560 truck trips and 280 car trips (workers), and then decline but remain nominally higher during well maintenance phases (68 truck trips per day throughout the Ranger District). Oil and gas would be distributed by existing underground pipelines and therefore road hazards due to increased traffic and spills would be minimized.

The summary recommendation of the Place Assessment report was that the Forest Service should allow almost no surface presence and should require mitigation for the impact of oil platforms and roads. Visual changes in the landscape would be greater during exploration and construction than during the maintenance phase, but would most likely be insubstantial when compared with the vast backdrop of the prairie and surrounding hills given the small number of wells reasonably foreseeable. Permanent wells and facilities spaced miles apart would be painted the colors of surrounding landscape similar to currently existing facilities (see Scenic Resources Figure 3.4-1). No substantial effect would be expected from the projected new leases.

Indirect Effects

No indirect effects would be expected under Alternative 2.

Irreversible Effects

No irreversible effects would be expected under Alternative 2.

Irretrievable Effects

During oil and gas leasing activities under Alternative 2, some irretrievable, short-term effects (from 14 to 42 months) would occur to traffic and local housing such as a potential increase in visitors (workers) at the hotel in Buffalo. Transportation to favorite spots for hunting or other activities could be affected during the construction period. Once construction of new wells and roads were completed, these temporary effects would end. Long-term irretrievable impacts due to new oil and gas leasing activities could occur to the visual environment and thus impact the perception of local residents that they live in a remote, pristine area. The arrival of new permanent workers to Harding County could also contribute directly to a sense of change in the community. These irretrievable effects would eventually be reversed once the wells were decommissioned.

Environmental Justice

Harding County's population is predominantly Caucasian (97.6 %) according to the U.S. Census Bureau (2002); however, there are Native American Reservations in the vicinity. Exploration and development of certain American Indian sacred lands such as Ludlow Cave and the surrounding area could have a disproportionate impact to Native American cultural and social practices in the area. Such impacts are substantially mitigated in this alternative since all of the North Cave Hills land unit is NSO.

Cumulative Effects

No substantial negative effects from existing oil and gas leases have been identified. No substantial negative effects would be expected from the projected foreseeable oil and gas leasing activities in combination with other activities in the area.

Harding County has just completed the Cave Hills road improvement project. No other projects by the County are planned within the oil and gas leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the exact amount of activity on state lands that would require permits through their office, but not many requests for permits are expected. The South Dakota State Department of Fish and Game,

Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects are expected as a result of these projects.

The State Land commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users about this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects approximately 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from Alternative 2 in addition to these existing activities.

3.6.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

This alternative would entail a smaller oil and gas exploration, development, and production effort than Alternative 2, but larger than the No Action Alternative due to additional mitigation measures to protect surface resources.

Direct Effects

During oil and gas leasing activities for the 19 new wells projected under Alternative 3, some insubstantial, short-term effects (from 8 to 23 months) would occur to traffic and local housing such as a potential increase in visitors (workers) at the hotel in Buffalo.

This analysis assumes that no more than one to two wells would be constructed and drilled at one time. Approximately 10 to 15 people would make up the temporary work crews and truck drivers hauling supplies to each of these wells, most likely from nearby counties in North Dakota. Once construction was complete, one to three maintenance employees would be required to maintain all nine wells (four existing, five additional). Approximately 37.3 jobs would be created during construction and 67.7 permanent jobs would be created due to direct, indirect, induced and total effects (DEIS Section 3.5.2.4).

An increase in workers to the area would bring an influx of money to the local economy both in the short-term and long-term. The 67.7 jobs expected under Alternative 3 would not represent a substantial negative effect on the existing social structure. The jobs created in Harding County would most likely be held by workers who live within the county and those from nearby counties, who would either commute or relocate. If these workers do relocate, they would be expected to share similar values with existing Harding County residents and would have a small positive impact to the economy. Even if new people moved to the area to fill all of the expected new jobs, the population would not rise above its current level of 0.5 persons per square mile. Sense of place and community would not be expected to be substantially and negatively disrupted by a small number of newcomers to the area (personal communication, Don Haefner, Continental Oil Company, October 30, 2002).

Traffic would increase during the exploration and construction phase (from 9.5 to 28.5 months) by approximately 266 truck trips and 190 car trips (workers), and then decline but remain nominally higher during well maintenance phases (38 truck trips per day throughout the Ranger District). Oil and gas would be distributed by existing underground pipelines and therefore road hazards due to increased traffic and spills would be minimized.

Transportation to favorite spots for hunting or other activities could be affected during the construction period. Once construction of new wells and roads were completed, these temporary effects would end. Long-term direct impacts due to new oil and gas leasing activities could occur to the visual environment and thus impact the perception of local residents that they live in a remote, pristine area.

Indirect Effects

No indirect effects would be expected to social resources under Alternative 3.

Irreversible Effects

No irreversible effects would be expected to social resources under Alternative 3.

Irretrievable Effects

During oil and gas leasing activities under Alternative 3, some irretrievable, short-term effects (from 8 to 23 months) would occur to traffic and local housing such as a potential increase in visitors (workers) at the hotel in Buffalo. Transportation to favorite spots for hunting or other activities could be affected during the construction period. Once construction of new wells and roads were completed, these temporary effects would end. Long-term irretrievable impacts due to new oil and gas leasing activities could occur to the visual environment and thus impact the perception of local residents that they live in a remote, pristine area. The arrival of new permanent workers to Harding County could also contribute directly to a sense of change in the community. These irretrievable effects would eventually be reversed once the wells were decommissioned.

Environmental Justice

Harding County's population is predominantly Caucasian (97.6%) according to the U.S. Census Bureau (2002); however, there are Native American Reservations in the vicinity. Exploration

and development of certain American Indian sacred lands such as Ludlow Cave and the surrounding area could have a disproportionate impact to Native American cultural and social practices in the area.

The average annual income within Harding County for the year 2000 was \$25,000. The effects of oil and gas leasing in Harding County would not be expected to disproportionately effect low-income Harding County residents since the County population is economically similar.

Cumulative Effects

No substantial negative effects from existing oil and gas leases have been identified. No substantial negative effects would be expected from the foreseeable oil and gas leasing activities in combination with other activities in the area.

Harding County has just completed the Cave Hills road improvement project. No other projects by the County are planned within the oil and gas leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the exact amount of activity on state lands that would require permits through their office, but not many requests for permits are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects are expected as a result of these projects.

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The Forest Service will continue with the following projects:

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- Continued grazing

The BLM expects approximately 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from Alternative 3 in addition to these existing activities.

3.7 ISSUE 7A: DISPERSED RECREATION

Recreation is realized through participation in various recreational activities occurring in preferred surroundings, or settings. The Forest Service manages recreation settings in order to provide opportunities for recreational experiences. Those experiences are also influenced by many other factors, including the recreationists' views, perceptions, and expectations. Experience has demonstrated that the public expects a range of recreation opportunities and settings on the Sioux Ranger District, from no development to fully developed campgrounds.

Within the project area, there are numerous dispersed sites that are referred to as Concentrated Use Areas. The project area is popular for hunting deer, turkey, antelope, and grouse (USFS n.d.). Oil and gas development activities have the potential to affect recreation values and activities within the project area in several ways. Travel over National Forest Roads (NFSRs) may be affected during exploration, drilling, and production operations. Expectations of a high quality visual experience, scenic driving (the nation's number one recreational activity), hunting, and other recreational activities could be affected by commercial traffic, drilling, and production activities.

Expectations regarding recreation were provided by local residents in Place Assessment focus groups (Leibert 1997). Hunting and fishing are important to nearby residents, especially because hunting provides an economic boost as well as a social outlet. Residents stated they would like to see the recreation settings of the five project areas be maintained in as natural a state as possible.

During scoping, two distinct aspects within the topic of recreation were identified: dispersed recreation and developed recreation. For the purposes of this analysis, these two recreation topics will be considered separately although it is recognized that they are related. For issues regarding potential visual impacts, see also Visual Resources, Section 3.4.

3.7.1 ELEMENTS COMMON TO BOTH DISPERSED AND DEVELOPED RECREATION

3.7.1.1 Recreation Setting

Harding County does not contain attraction features for most vacation-oriented visitors. The landscapes found here are not ones that most people travel to see, i.e., mountains with summer snow caps; vast, lush forested areas surrounding fresh mountain streams; or fresh water lakes. Rather, the plains of Harding County offer seemingly endless horizons of open prairie. Boring to some people, awesome to others, the prairie has different attractions for different people. The open grasslands have a scattered array of hills throughout. The hills can be seen for miles and are dotted with pine trees. These hilly formations appear as islands in the grass and are therefore referred to as "prairie isles."

The prairie isles are on National Forest System lands and are the sources for spring water, shade, winter cover, habitat for wildlife, and solitude. Although visible for many miles and reasonably accessible, the prairie isles are off the main routes and visitors must make a special effort to visit them. Consequently, they receive limited visitor use.

The project area setting consists of hilly formations dotted with trees surrounded by endless seas of grass. Water is scarce. Developments are few and far between. The areas are not heavily populated and appear to be quite remote. Lack of water is a problem for the rancher as well as recreation users. Water from the various springs generally does not meet the federal minimum standards for potable water. Many of the roads are conducive only to four-wheel drive vehicles rather than two-wheel drive passenger cars. The cliffs form natural barriers making access to the tabletops limited.

The trees offer visual relief as well as relief from elements. Their aesthetic value is quite high due to their scarcity.

3.7.1.2 Demand for Dispersed Recreation Opportunities

Visitor use and demand for recreation opportunities in the Sioux Ranger District is projected to stay at approximately the same levels. Forest wide, demand will be greatest at or near water, at developed recreation sites, and along roads. It is these developed facilities that become take-off points for dispersed activities such as hiking, hunting, and picnicking. The Sioux Ranger District provides a unique opportunity for isolated activities due to the low number of users.

3.7.1.3 Recreation Opportunity Spectrum (ROS) System

The Forest Service has developed the Recreation Opportunity Spectrum (ROS) classification system to characterize and analyze recreation opportunity. The ROS provides a framework for stratifying, defining, and managing classes of outdoor recreation settings, activities, and experience opportunities. As shown in Table 3.7-1, the ROS is a continuum, or spectrum, that has been divided into six classes, identifying recreational opportunities ranging from most-developed to least-developed settings.

Maintaining a broad spectrum of ROS classes is important in order to provide the public with choices in recreation opportunities.

Adopted ROS Classes

Current direction for management of recreation resources is found in the Custer National Forest Land and Resource Plan (1987, p. 13-14). Adopted ROS classes embody management direction for recreation opportunities.

ROS and Oil & Gas Facility Density

Table 3.7-2 estimates an upper limit density per square mile of oil and gas facilities based on the Recreation Opportunity Spectrum (ROS) class.

Table 3.7-1. Recreation Opportunity Spectrum (ROS) Classes

Acronym	Recreation Setting	Definition
(U)	Urban	Does not apply to the Sioux Ranger District.
(R)	Rural	Characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high.
(RN)	Roaded Natural	Where timber harvest or other surface practices are evident. Motorized vehicles are permitted on all or parts of the road system.
(SPM)	Semi-Primitive Motorized	Characterized by a predominately natural or natural-appearing environment of a moderate to large size. Concentration of users is low, but there is often evidence of other area users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized vehicles are permitted on all or parts of the road system.
(SPNM)	Semi-Primitive Non-Motorized	Similar to Semi-Primitive Motorized except that vehicles are prohibited.
(P)	Primitive	Characterized by an essentially unmodified natural environment of a size or remoteness that provides substantial opportunity for isolation from the signs and sounds of man and a feeling of vastness of scale. Visitors have the opportunity to be part of the natural environment, encounter a high degree of challenge, and use a maximum of outdoor skills, but have minimum opportunity for social interaction.

Table 3.7-2. Estimated Maximum Allowable Oil and Gas Facilities per Square Mile by ROS Class

Type of Facility	Recreation Opportunity Spectrum (ROS) Class					
	Urban	Rural	Roaded Natural	Semi-Primitive Motorized	Semi-Primitive Non-Motorized	Primitive
Number of Oil Wells	50	40	16	8	0	0
Number of Well Pads, Treatment Facilities, and/or Tank Farms	16	13	5	3	0	0
Miles of Roads	9	7	2.8	1.4	0	0
Miles of Pipelines	9	7	2.8	1.4	0	0

3.7.1.4 Forest Plan Goal and Objectives

The stated recreation management goal of the Custer National Forest Management Plan is "to provide a broad spectrum of recreation experience opportunities for the benefit and enjoyment of the public, with due consideration for other forest uses and resources" (USFS 1987, p. 4).

The stated objectives are that "management of the recreation resource is moderately intensive and developed recreation sites will be operated at a full service level. Some areas are managed for dispersed recreation and the existence of these areas will be more visible to the public." (USFS 1987, pg. 4.)

3.7.1.5 Forest Plan Management Standards

Dispersed Sites

Forest Plan Management standards regarding Dispersed Sites are outlined as follows:

- Dispersed recreation opportunities will be emphasized in response to public needs.
- NFS lands will be identified. Signs will be used to guide the public to NFS lands.
- Dispersed use will be managed to prevent site deterioration. Generally, no specific campsites will be established or maintained. Minimum impact camping techniques will be encouraged through public information.

Off-Highway Vehicle (OHV) Use

The USFS and BLM issued a decision notice in January 2001 restricting OHV use to existing designated roads. No OHV use is allowed off of roads. Travel restrictions will continue to be developed and maintained to meet land management objectives. These restrictions will provide reasonable access for public recreation, hunting, and range maintenance/administration, but will confine motorized vehicles to existing roads identified on a map. Vehicular access off these designated locations is prohibited, except by permit.

3.7.2 AFFECTED ENVIRONMENT

3.7.2.1 Sioux Ranger District Dispersed Recreation Opportunities and Use

The landscape in Harding County is magnificent: cooling breezes through the pines, birds in flight, and human development is not at all obvious or obtrusive. Hunters who come to the area in fall are the primary users, for both hunting and camping. Major dispersed sites include the Castles National Landmark (see DEIS Section 3.16) and Ludlow Cave (USFS n.d.). Road access is available to and within all five land units in this project area.

Information obtained from the 1995 Recreation Information Management (RIM) System for the CNF indicates approximately 6,400 Recreation Visitor Days (RVD) for the Sioux Ranger District in South Dakota. A RVD is a 12-hour visit by one person. These figures are small compared to 522,000 RVDs for the Beartooth Ranger District or over 115,000 RVDs for the Little Missouri National Grasslands to the north, but they are substantial to the areas involved. Recreation overuse has not been a problem on the Sioux Ranger District.

Activities in the dispersed category are general day camping, various viewing activities, ice and snow craft travel, all terrain vehicle travel, nature studies and education, hiking and walking, horseback riding, sledding and other snow play, and hunting (see Table 3.7-3).

Hunting accounts for the largest use. Harding County has been and continues to be a favorite spot for hunting mule deer in South Dakota. This is attributed to higher percentages of hunter success. The second major use is hiking and walking, with horseback riding and nonconsumptive fish and wildlife use third.

Table 3.7-3. Visitor Days of Dispersed Recreation Use¹

Activity Grouping	1990	1991	1992	1993	1994	1995
Camping General Day	0.1	0.2	0.1	0.1	0.1	0.1
Viewing Scenery	0.3	0.3	0.3	0.1	0.1	0.1
Viewing Activities	0.2	0.2	0	0	0	0
Viewing Works of Humankind	0.1	0.1	0	0	0	0
Ice and Snow Craft Travel	0	0	0.1	0	0	0
Specialized Landcraft Travel	0	0	0	0.1	0.1	0.1
Nature Study, Hobby, Education	0.3	0.3	0.3	0.2	0.2	0.2
Hiking and Walking	0.5	0.5	0.5	0.3	0.3	0.3
Horseback Riding	0.4	0.4	0.4	0.2	0.2	0.2
Sledding, Tobogganing	0	0	0.1	0.1	0.1	0.1
Snow Play	0.4	0.4	0.3	0.2	0.2	0.2
Cross-Country Skiing, Snowshoeing	0	0	0.1	0.1	0.1	0.1
Hunting - Big Game	0.8	0.8	0.8	0.8	0.8	0.8
Hunting - Small Game	0.2	0.2	0.2	0.1	0.1	0.1
Hunting - Upland Birds	0.3	0.3	0.3	0.1	0.1	0.1
Non-Consumptive Fish and Wildlife Use	0.4	0.4	0.4	0.2	0.2	0.2
Other Recreation Activities	2.0	2.0	1.1	0.6	0.6	0.6
TOTAL (Thousands)	6.0	6.1	5.0	3.2	3.2	3.2

¹A recreation visitor day is a 12-hour visit by one person.

Source: USFS Recreation Inventory and Management Report 1990-95

The Sioux Ranger District supplies recreation opportunities for Harding County, South Dakota and the surrounding area including Butte County, SD and Bowman County, ND. Visitors are attracted to the Sioux Ranger District by the variety of terrain, vegetation, and recreational settings, including rocky buttes, prairies, and riparian areas that contribute to visual experiences and wildlife habitat.

Wilderness and Roadless Areas

There are currently no designated Wilderness or Inventoried Roadless Areas on the Sioux Ranger District. Road access currently exists to and within all the land units being considered for leasing in this study. Consequently, none of the land units being considered for leasing within the Sioux Ranger District would be eligible for wilderness or roadless status.

Trails

There are currently no designated trails on the Sioux Ranger District.

Roads

The road system provides access within the Forest and serves as a focal point for many dispersed recreation activities. There are approximately 71 miles of unimproved roads. These roads provide day-use and extended opportunities for both non-motorized and motorized activities. This road system is used for a variety of activities including hiking, horseback riding, and OHV use, and for access to hunting, fishing, and nature study opportunities.

3.7.2.2 Affected Environment by Unit***North Cave Hills***

The North Cave Hills unit (14,547 acres) is located in the northern part of the Sioux Ranger District near the state borders of South Dakota, North Dakota, and Montana, approximately 30 miles north of the town of Buffalo, SD. There are approximately 45 miles of roads, 8 miles of unimproved roads, and one developed campsite (Picnic Springs) within the North Cave Hills unit. Browns Pond, a popular fishing area, has recently been purchased and added to National Forest System lands. There are also numerous springs and small reservoirs available for limited dispersed recreation.

Allocated Management Areas (MAs) within North Cave Hills are identified in Table 3.7-4.

There are two large areas, one to the north (2,423 acres) and another in the center (358 acres), totaling 2,784 acres of existing oil and gas leases within the North Cave Hills unit. There are currently three wells, two oil and one injector, within these leasing areas. All three wells are located within Management Area E—Minerals Management and do not interfere with dispersed recreational activities.

Table 3.7-4. Management Areas, Acres, and Prescribed Recreation Standards in the North Cave Hills

Management Area	Acres	Prescribed Recreation Standards
C – Rimrock	1,979	<ul style="list-style-type: none"> No specific dispersed campsites will be established or maintained. Minimum impact camping will continue to be emphasized. Portions of big game range will be closed seasonally as determined by on-the-ground evaluation. Vehicles including snowmobiles may be restricted on big game winter range as needed to meet wildlife needs.
E – Minerals Management	11,341	<ul style="list-style-type: none"> The recreation setting will generally be Roaded Natural and Rural, although Semi-Primitive Motorized will occur throughout the area.
F – Developed Recreation	30	<ul style="list-style-type: none"> The recreation setting will vary among the developed sites from Semi-Primitive, Motorized, Roaded-Natural, and Rural. Sites will be characterized by predominantly natural or natural-appearing environments to a substantially modified natural environment. <p>Oil and Gas Development</p> <ul style="list-style-type: none"> Mitigation measures may include actions such as timing, seasonal, or location restrictions. Design of features will meet Visual Quality Objectives. A No Surface Occupancy lease stipulation will be applied to all developed recreation sites. A Surface Occupancy Restriction (timing) stipulation will be applied to all new oil and gas leases within one-quarter mile of developed sites from May 15 to September 15.
M – Riparian	130	<ul style="list-style-type: none"> The recreation setting will be Semi-Primitive Non-Motorized. Where roads and/or trails exist, the setting may be Semi-Primitive Motorized, Roaded-Natural, or Rural.
N – Woody Draws	939	<ul style="list-style-type: none"> Generally, trails will not be constructed in the woody draws except as needed to cross the area. The natural-appearing landscape will remain dominant and most management activities will not be evident.

Source: Custer National Forest Management Plan 1987, pages 49, 50, 58, 61, 62, 80, and 83.

South Cave Hills

The South Cave Hills unit (8,876 acres) is located below the North Cave Hills unit and is the closest to the town of Buffalo (approximately 12 miles to the south). There are approximately 29 miles of improved roads and 10 miles of unimproved roads. There are no developed fishing, camping, or picnicking sites. There are several springs as well as a small reservoir available for limited dispersed recreation. Allocated Management Areas (MAs) within the South Cave Hills unit are identified in Table 3.7-5.

There are currently 1,623 acres of existing oil and gas leases within South Cave Hills, along the southern border. There are currently two existing wells within the boundaries of these leasing areas. One of these wells is located within Management Area B–Rangeland and does not interfere with dispersed recreational activities. The other well is located outside of NFS lands.

Table 3.7-5. Management Areas, Acres, and Prescribed Recreation Standards in the South Cave Hills

Management Area	Acres	Prescribed Recreation Standards
B – Range	6,844	<ul style="list-style-type: none"> • Semi-Primitive and Roaded Natural recreation opportunities will be provided.
C – Rimrock	1,167	<ul style="list-style-type: none"> • No specific dispersed campsites will be established or maintained. Minimum impact camping will continue to be emphasized. • Portions of big game range will be closed seasonally as determined by on-the-ground evaluation. • Vehicles including snowmobiles may be restricted on big game winter range as needed to meet wildlife needs.
M – Riparian	88	<ul style="list-style-type: none"> • The recreation setting will be Semi-Primitive Non-Motorized. Where roads and/or trails exist, the setting may be Semi-Primitive Motorized, Roaded-Natural, or Rural.
N – Woody Draws	266	<ul style="list-style-type: none"> • Generally, trails will not be constructed in the woody draws except as needed to cross the area. • The natural-appearing landscape will remain dominant and most management activities will not be evident.

Source: Custer National Forest Management Plan 1987, pages 49, 50, 58, 61, 62, 80, and 83.

Slim Buttes

The Slim Buttes unit (46,972 acres) is located approximately 15 miles east of the town of Buffalo, SD. It runs north/south for approximately 25 miles and east/west for approximately 5 to 20 miles. The Castles National Natural Landmark (Castles NNL) is located within this unit and will be addressed under a separate section. There are approximately 105 miles of improved roads and 45 miles of unimproved roads. This unit contains one developed campground (Reva Gap), and three points of interest (the Castles NNL, Jesse Elliot Ranger Station, and Summit Pass). There is one designated fishing reservoir at Rabbit Creek Dam. There are also numerous springs as well as small reservoirs available for limited dispersed recreation. Eight peaks are located within this unit. Saddle Point (elev. 1090) is accessible by an unimproved road. South Divide Road, approximately five miles, is a designated OHV road (USFS 2001). Allocated Management Areas (MAs) within the Slim Butte Hills unit are identified in Table 3.7-6.

There are no existing oil and gas leasing areas within the Slim Buttes unit.

Table 3.7-6. Management Areas, Acres, and Prescribed Recreation Standards in the Slim Buttes

Management Area	Acres	Prescribed Recreation Standards
B – Range	33,599	<ul style="list-style-type: none"> Semi-Primitive and Roaded Natural recreation opportunities will be provided.
C – Rimrock	4,669	<ul style="list-style-type: none"> No specific dispersed campsites will be established or maintained. Minimum impact camping will continue to be emphasized. Portions of big game range will be closed seasonally as determined by on-the-ground evaluation. Vehicles including snowmobiles may be restricted on big game winter range as needed to meet wildlife needs.
D – Wildlife/Fish	927	<ul style="list-style-type: none"> The travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads during critical periods to protect wildlife and other resources. Access control structures may be used to protect wildlife and other resources.
F – Developed Recreation	119	<ul style="list-style-type: none"> The recreation setting will vary among the developed sites from Semi-Primitive, Motorized, Roaded-Natural, and Rural. Sites will be characterized by predominantly natural or natural-appearing environments to a substantially modified natural environment. <p>Oil and Gas Development</p> <ul style="list-style-type: none"> Mitigation measures may include actions such as timing, seasonal, or location restrictions. Design of features will meet Visual Quality Objectives. A No Surface Occupancy lease stipulation will be applied to all developed recreation sites. A Surface Occupancy Restriction (timing) stipulation will be applied to all new oil and gas leases within one-quarter mile of developed sites from May 15 to September 15.
L – Research Natural Areas (RNA)	117	<ul style="list-style-type: none"> Recreation use will not be encouraged. Trails will not be constructed in these areas.
M – Riparian	172	<ul style="list-style-type: none"> The recreation setting will be Semi-Primitive Non-Motorized. Where roads and/or trails exist, the setting may be Semi-Primitive Motorized, Roaded-Natural, or Rural.
N – Woody Draws	3,118	<ul style="list-style-type: none"> Generally, trails will not be constructed in the woody draws except as needed to cross the area. The natural-appearing landscape will remain dominant and most management activities will not be evident.
O – National Natural Landmark	849	<ul style="list-style-type: none"> The recreation setting will be Roaded Natural. Road and interpretive signing will be used to inform the public about the Castles National Natural Landmark.
P – Administrative Site	3	<ul style="list-style-type: none"> Interpretive facilities may be used at these sites to inform the public.

Source: Custer National Forest Management Plan 1987, pages 49, 50, 58, 61, 62, 80, and 83.

West Short Pines

The West Short Pines unit (1,264 acres) is located approximately 10 miles south of Camp Crook, SD. There are approximately 3.6 miles of improved roads and 2 miles of unimproved roads. There are three springs but no peaks available for dispersed recreational activities. It is a small area in terms of overall available recreation areas but it is the closest NFS land to the town of Camp Crook. Table 3.7-7 outlines the existing Management Areas contained within the West Short Pines unit.

The north end of this unit has an existing oil and gas lease area of 153 acres with no existing wells; however, this lease has expired. There is a drill hole on the south end of the unit. Neither the lease area nor the drill hole interferes with existing developed recreation.

Table 3.7-7. Management Areas, Acres, and Prescribed Recreation Standards in the West Short Pines

Management Area	Acres	Prescribed Recreation Standards
C – Rimrock	86	<ul style="list-style-type: none"> No specific dispersed campsites will be established or maintained. Minimum impact camping will continue to be emphasized. Portions of big game range will be closed seasonally as determined by on-the-ground evaluation. Vehicles including snowmobiles may be restricted on big game winter range as needed to meet wildlife needs.
D – Wildlife/Fish	964	<ul style="list-style-type: none"> The travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads and trails during critical periods to protect wildlife and other resources. Access control structures may be used to protect wildlife and other resources.
M – Riparian	4	<ul style="list-style-type: none"> The recreation setting will be Semi-Primitive Non-Motorized. Where roads and/or trails exist, the setting may be Semi-Primitive Motorized, Roaded-Natural, or Rural.
N – Woody Draws	12	<ul style="list-style-type: none"> Generally, trails will not be constructed in the woody draws except as needed to cross the area. The natural-appearing landscape will remain dominant and most management activities will not be evident.

Source: Custer National Forest Management Plan 1987, pages 49, 50, 58, 61, 62, 80, and 83.

East Short Pines

The East Short Pines unit (6,147 acres) is located approximately 20 miles south and 5 miles east of Buffalo, SD. There are approximately 12 miles of roads, 6 miles of unimproved roads, no designated trails, and no developed fishing, camping, or picnicking sites. There are several springs and two peaks available for dispersed recreational activities. There are several designated Management Areas as indicated in Table 3.7-8.

There currently are no existing oil and gas leases within the East Short Pines unit.

Table 3.7-8. Management Areas, Acres, and Prescribed Recreation Standards in the East Short Pines

Management Area	Acres	Prescribed Recreation Standards
C – Rimrock	1,199	<ul style="list-style-type: none"> No specific dispersed campsites will be established or maintained. Minimum impact camping will continue to be emphasized. Portions of big game range will be closed seasonally as determined by on-the-ground evaluation. Vehicles including snowmobiles may be restricted on big game winter range as needed to meet wildlife needs.
D – Wildlife/Fish	4,705	<ul style="list-style-type: none"> The travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads and trails during critical periods to protect wildlife and other resources. Access control structures may be used to protect wildlife and other resources.
M – Riparian	8	<ul style="list-style-type: none"> The recreation setting will be Semi-Primitive Non-Motorized. Where roads and/or trails exist, the setting may be Semi-Primitive Motorized, Roaded-Natural, or Rural.
N – Woody Draws	163	<ul style="list-style-type: none"> Generally, trails will not be constructed in the woody draws except as needed to cross the area. The natural-appearing landscape will remain dominant and most management activities will not be evident.

Source: Custer National Forest Management Plan 1987, pages 49, 50, 58, 61, 62, 80, and 83.

Surrounding Area

Several other nearby public land areas are available for dispersed recreation including large tracks of BLM land in southeast Montana. The Long Pines, Ekalaka Hills, and Chalk Buttes in southeast Montana are also part of the Sioux Ranger District and provide comparable settings and opportunities for recreation. These other areas, however, do not have the unique rock formations that are located within the project area.

3.7.3 ENVIRONMENTAL CONSEQUENCES

This section describes impacts that could occur to recreational opportunities and how Forest Plan compliance would be affected by oil and gas exploration and development under the alternative leasing scenarios considered. Effects are measured in miles of road, ROS class, additional land use, and changes in traffic.

Impacts to recreation opportunities that may result from oil and gas activities are listed in Table 3.7-9 by ROS class.

Table 3.7-9. Typical Impacts to Recreation Opportunities from Oil and Gas Activities by ROS Class

Potential Impact Area	Potentially Substantial Direct Effects	Potentially Substantial Indirect Effects
Semi-Primitive Non-Motorized (SPNM) ROS Areas	Oil and gas activities and facilities are not consistent with the norm condition setting indicators for the <i>Semi-Primitive Non-Motorized</i> ROS class. Construction of even primitive roads would change the ROS setting from <i>Semi-Primitive Non-Motorized</i> to <i>Semi-Primitive Motorized</i> . The access improvements and presence of facilities would alter the sense of remoteness and naturalness.	Oil and gas development outside of <i>Semi-Primitive Non-Motorized</i> ROS class areas can indirectly disrupt the opportunity for a primitive recreational experience within. This can result through sights, sounds, vibrations, and odors that are detectable from within designated <i>Semi-Primitive Non-Motorized</i> ROS class areas. Oil and gas activities and facilities could substantially impact the recreational experience if located within close proximity of <i>Semi-Primitive Non-Motorized</i> ROS class areas and are perceptible within the area.
Semi-Primitive Motorized (SPM) ROS Areas	The norm condition indicators for the <i>Semi-Primitive Motorized</i> ROS class, can, under limited conditions, be consistent with low density oil and gas activities and facilities. However, access and facilities would need to be heavily constrained to provide for only primitive access, rustic facilities, and be located to be outside the sight and sound distances of trails and utilized dispersed recreation areas. Potentially substantial recreational effects could occur if these requirements are not met. These requirements may make the oil and gas operation not economically feasible.	Oil and gas activities and facilities may have indirect recreational effects on <i>Semi-Primitive Motorized</i> ROS class areas if they are within such close proximity that they adversely impact the norm condition indicators for the ROS class.
Roaded Natural (RN) ROS Areas	Effectively planned, designed, and implemented oil and gas activities and facilities, within the densities limits, can be within the norm condition indicators for the <i>Roaded Natural</i> ROS class. Potentially substantial recreational effects could occur if these densities or ROS norm conditions are exceeded.	Oil and gas activities and facilities may have indirect recreational effects on <i>Roaded Natural</i> ROS class areas if they are within such close proximity that they adversely impact the norm condition indicators for the ROS class.
Rural (R) ROS Areas	The norm condition indicators for the <i>Rural</i> ROS class are consistent with oil and gas activities and facilities within the densities limits. Potentially substantial recreational effects could occur if these densities or ROS setting indicator norm conditions are exceeded.	Oil and gas activities outside of <i>Rural</i> ROS areas would not have substantial indirect effects on recreational opportunities within the <i>Rural</i> ROS area.
Developed Recreation Sites	Oil and gas activities and facilities are not consistent with developed recreation sites. If an oil and gas activity or facility were located within a developed recreation site such as a campground or day use area, substantial direct effects would occur to the recreation experience.	Oil and gas activities and facilities are not consistent with developed recreation sites. Oil and gas activity or facility can adversely impact the recreational experience within close proximity of a developed site. This can result through sights, sounds, vibrations, and odors that are detectable from developed recreation sites.

3.7.3.1 Alternative 1 - No Action, No New Leases

No additional Forest System lands would be leased for oil and gas development under the No Action Alternative. However, any lands within existing lease areas could be developed further for oil and gas activities consistent with existing lease stipulations. This could include construction of new roads, pads, pipelines, and other oil and gas exploration and development activities. Impacts from past and present projects would continue and possible expansion of activities and facilities within existing lease areas could cause additional impacts. If implemented, the Alternative 1 leasing scenario could result in impacts to the recreation values of the forest.

Three areas of potential effects include:

- Effects to recreational travel during construction of drilling sites due to increased vehicle traffic.
- Effects to the visual quality of the Forest once the oil wells are constructed, which could affect recreational scenic viewing.
- Effects to recreational hunting due to herd dispersal caused by increased traffic and noise levels at the drill site.

North Cave Hills

Under Alternative 1, conditions for dispersed recreation would not change substantially. Due to existing leases, 0.3 mile of additional road could be built within the North Cave Hills unit to service two projected wells. This represents less than a one percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this represents a short-term irretrievable effect, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The two projected wells, along with facilities and roads, would be located within Management Area E—Minerals Management, which calls for the recreation setting to “generally be roaded natural and rural, although semi-primitive motorized will occur throughout the area” (USFS 1987, pg. 58). Two wells within this unit in addition to the two existing wells would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Additional land used for the two projected wells would be approximately 10 acres. Considering that the entire unit is over 14,000 acres, this would not represent a substantial impact to dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These oil and gas development activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No

substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

South Cave Hills

Under Alternative 1, conditions for dispersed recreation would not change substantially. Due to existing leases, 0.4 mile of additional road could be built within the South Cave Hills unit to service three projected wells. This represents less than a one percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this land area represents a short-term irretrievable impact, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The three projected wells, along with facilities and roads, would be located within Management Area B–Range, which states, “semi-primitive and roaded natural recreation opportunities will be provided” (USFS 1987, p. 45). Three wells within this unit in addition to the one existing well would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Additional land used for the three projected wells would be approximately 15 acres. Considering that the entire unit is over 8,000 acres, this would not represent a substantial impact to dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These oil and gas development activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected under the No Action Alternative within the South Cave Hills unit.

Slim Buttes

Under the No Action Alternative, conditions for dispersed recreation would remain as they currently are since there are no existing leases within this land unit. No substantial direct, indirect, irreversible, irretrievable, short-term, long-term or cumulative effects on dispersed recreation are expected.

West Short Pines

Under the No Action Alternative, conditions for dispersed recreation would remain as they currently are since existing leases within the West Short Pines unit have expired. No substantial direct, indirect, irreversible, irretrievable, short-term, long-term or cumulative effects on dispersed recreation are expected.

East Short Pines

Under the No Action Alternative, conditions for dispersed recreation would remain as they currently are since there are no existing leases within this land unit. No substantial direct, indirect, irreversible, irretrievable, short-term, long-term or cumulative effects on dispersed recreation are expected.

Direct Effects

Under the No Action Alternative, five new wells could be constructed within all of the proposed units. Approximately 0.7 mile of new road could be built to access these new wells. Access to portions of the Forest could be inhibited in those five locations if a forest visitor attempts travel on a NFS Road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS Roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term (two to six months), direct irretrievable interruption to public access and thus dispersed recreation.

Indirect Effects

Indirect effects are addressed under *Cumulative Effects*.

Irreversible Effects

No irreversible effects are expected under the No Action Alternative.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect developed recreation. No activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create direct cumulative effects to developed recreation. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects are expected as a result of these projects.

Harding County has just completed the Cave Hills road improvement project. No other projects by the county are planned within the Oil and Gas Leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the amount of activity on state lands that would require permits through their office but not many are expected.

The State Land commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects are expected from the No Action Alternative in addition to these other activities.

3.7.3.2 Alternative 2 – Lease with Forest Plan Stipulations

Additional Forest System lands would be leased for oil and gas development under Alternative 2. Lands within existing lease areas could also be further developed for oil and gas activities consistent with existing lease rights. This could include construction of new roads, pads, pipelines, and other oil and gas exploration and development activities. Impacts from past and present projects would continue, and possible expansion of activities and facilities within new and existing lease areas could cause additional impacts. There is a potential for the Alternative 2 leasing scenario to result in impacts to recreation values of the Forest if implemented.

Three areas of potential effects include:

- Effects to recreational travel during construction of drilling sites due to increased vehicle traffic.
- Effects to the visual quality of the Forest once the oil wells are constructed, which could affect recreational scenic viewing.
- Effects to recreational hunting due to herd dispersal caused by increased traffic and noise levels at the drill site.

North Cave Hills

Under Alternative 2, conditions for dispersed recreation would be expected to change slightly. Approximately 1.8 miles of additional roads could be built within the North Cave Hills unit to service 12 projected wells. This represents a four percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time.

As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this represents a short-term irretrievable effect, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The 12 projected wells, along with facilities and roads, would be located within Management Area E—Minerals Management, which calls for the recreation setting to be “generally roaded natural and rural, although semi-primitive motorized will occur throughout the area” (USFS 1987, pg. 58). Twelve wells within this unit in addition to the two existing wells would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Additional land used for the 12 projected wells would be approximately 60 acres. Considering that the entire unit is over 14,000 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

South Cave Hills

Under Alternative 2, conditions for dispersed recreation would be expected to change slightly. Approximately 2.6 miles of additional road could be built within the South Cave Hills unit to service ten projected wells. This represents an 8.8 percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this land area represents a short-term irretrievable effect, it is not substantial. Some of these roads may not be located on NFS lands. All of the roads located on NFS lands would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The ten projected wells, along with facilities and roads, could either be located off of NFS lands or within Management Area B—Range, which states, “semi-primitive and roaded natural recreation opportunities will be provided” (USFS 1987, p. 45). Ten wells within this unit in addition to the one existing well would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Additional land used for the ten projected wells would be approximately 50 acres. Considering that the entire unit is over 8,000 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately three to seven months if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on

hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

Slim Buttes

Under Alternative 2, conditions for dispersed recreation would be expected to change slightly. Approximately 0.3 mile of additional road could be built within the Slim Buttes unit to service three projected wells. This represents less than a one percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this land area represents a short-term irretrievable impact, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The three projected wells, along with facilities and roads, would either be located off of NFS lands or within Management Area B–Range, which states, “semi-primitive and roaded natural recreation opportunities will be provided” (USFS 1987, p. 45). Three wells within this unit would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Approximately 15 acres of newly disturbed land would be used for the three projected wells. Considering that the entire unit is over 43,574 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

West Short Pines

Under Alternative 2, conditions for dispersed recreation would be expected to change slightly. Approximately 0.3 mile of additional road could be built within the West Short Pines unit to service two projected wells. This represents an 8.4 percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and therefore, although this represents a short-term irretrievable effect, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The two projected wells, along with facilities and roads, would be located within Management Area D–Wildlife/Fish, which states, “the travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads during critical periods to protect wildlife and other resources” (USFS 1987, p. 53). Two wells within this unit would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Approximately 10 acres of newly disturbed land would be used for the four projected wells. Considering that the entire unit is over 1,200 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects to dispersed recreation are expected.

East Short Pines

Under Alternative 2, conditions for dispersed recreation would be expected to change slightly. Approximately 0.1 mile of additional road could be built within the East Short Pines unit to service one projected well. This represents less than a one percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this would represent a short-term irretrievable effect, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The one projected well, along with facilities and roads, would be located within Management Area D–Wildlife/Fish, which states, “the travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads during critical periods to protect wildlife and other resources” (USFS 1987, p. 53). One well within this unit would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Approximately five acres of newly disturbed land would be used for the four projected wells. Considering that the entire unit is over 6,000 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected within this unit.

Direct Effects

Under Alternative 2, 28 new wells and 5.1 miles of road are projected to be constructed. Access to portions of the Forest could be inhibited in those 28 locations if a forest visitor attempts travel on a NFS Road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS Roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term (10 to 28 months), direct irretrievable interruption to public access and therefore dispersed recreation.

Indirect Effects

No indirect effects would be expected under Alternative 2.

Irreversible Effects

No irreversible effects would be expected under Alternative 2.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect developed recreation. Development of each unit is not expected to take place simultaneously, but rather consecutively, with one or two wells being developed at a time. No additional activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create cumulative effects to dispersed recreation.

3.7.3.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

Under the Alternative 3 leasing scenario, all five land units would be offered for lease. However, supplementary lease stipulations, in addition to the Alternative 2 stipulations, would be added to further protect surface resources. Activities under Alternative 3 would include construction of new roads, pads, pipelines, and other oil and gas exploration and development activities. Impacts from past and present projects would continue and possible expansion of activities and facilities within new and existing lease areas could cause additional impacts. There is a potential for Alternative 3 to affect recreation values of the forest.

Three areas of potential effects include:

- Effects to recreational travel during construction of drilling sites due to increased vehicle traffic.
- Effects to the visual quality of the Forest once the oil wells are constructed, which could affect recreational scenic viewing.

- Effects to recreational hunting due to herd dispersal caused by increased traffic and noise levels at the drill site.

North Cave Hills

Under Alternative 3, the entire North Cave Hills land unit would be under a NSO stipulation to protect cultural resources. As a result, seven of the projected RFD wells are eliminated and the remaining five projected wells would be located off of NFS lands. These wells would need to be close enough to the Forest boundary to access the subsurface resource by horizontal or slant drilling. Since the wells would be off-Forest, they would be at a lower elevation in the grasslands below the mesas. There would be no direct impacts to dispersed recreation users within the Forest on the mesas. There could be a low level of traffic impacts to dispersed recreation users en route to the Forest. Additional land used for the five projected wells would be approximately 29 acres.

In a worst-case scenario, disruption to hunting could occur for approximately two months if construction and exploration took place during hunting seasons on access routes. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

South Cave Hills

Under Alternative 3, conditions for dispersed recreation would be expected to be approximately the same as under Alternative 2. Approximately 3.3 miles of additional road could be built within the South Cave Hills unit to service nine projected wells. This represents a six percent increase in miles of road within this unit, which would not be expected to disrupt existing dispersed recreation

activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this land area represents a short-term irretrievable effect, it is not substantial. Some of these roads may not be located on NFS lands. All of the roads located on NFS lands would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The nine projected wells, along with facilities and roads, would either be located off of NFS lands or be located within Management Area B–Range, which states, “semi-primitive and roaded natural recreation opportunities will be provided” (USFS 1987, p. 45). Nine wells within this unit in addition to the one existing well would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Additional land used for the nine projected wells would be approximately 45 acres. Considering that the entire unit is over 8,000 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately three to seven months if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

Slim Buttes

Under Alternative 3, the entire Slim Buttes land unit would be under a NSO stipulation to protect cultural resources. As a result, two of the projected RFD wells are eliminated and the remaining two projected wells would be located off of NFS lands. These wells would need to be close enough to the Forest boundary to access the subsurface resource by horizontal or slant drilling. There could be a low level of traffic impacts to dispersed recreation users en route to the Forest. Additional land used for the two projected wells would be approximately 11 acres.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected.

West Short Pines

Under Alternative 3, conditions for dispersed recreation would be the same as under Alternative 2. Approximately 0.3 mile of additional road could be built within the West Short Pines unit to service two projected wells. This represents an approximately four percent increase in miles of road within this unit, which is not expected to disrupt existing dispersed recreational activities due to 1) the small increase in road miles, 2) the large acreage of the unit compared to the estimated number of dispersed recreational users, 3) the temporary timeframe that oil and gas development will be taking place, and 4) the fact that only one to three well locations could be developed at a time. As stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and therefore, although this represents a short-term irretrievable effect, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The two projected wells, along with facilities and roads, would be located within Management Area D–Wildlife/Fish, which states, “the travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads during critical periods to protect wildlife and other resources” (USFS 1987, p. 45). Two wells within this unit would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Approximately 10 acres of newly disturbed land would be used for the four projected wells. Considering that the entire unit is over 1,200 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects to dispersed recreation are expected.

East Short Pines

Under Alternative 3, conditions for dispersed recreation would be expected to be the same as under Alternative 2. No additional roads would be expected to be built within the East Short Pines unit to service the one projected well. If roads were to be built, as stated in the Forest Plan, these roads would not be open to the public (USFS 1987, p. 36), and although this would represent a short-term irretrievable effect, it is not substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987, p. 36).

The one projected well and associated facilities would be located within Management Area D–Wildlife/Fish, which states, “the travel plan for these areas will provide reasonable access for public recreation, hunting, and range maintenance and administration, but will confine motorized vehicles to specific roads during critical periods to protect wildlife and other resources” (USFS 1987, p. 45). One well within this unit would not exceed the limit of eight wells per square mile to meet the designated ROS classes. Approximately five acres of newly disturbed land would be used for the four projected wells. Considering that the entire unit is over 6,100 acres, this would not represent a substantial effect on dispersed recreation.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, indirect, irreversible, long-term or cumulative effects on dispersed recreation are expected within this unit.

Direct Effects

Under Alternative 3, 19 new wells and 4.6 miles of road could be constructed. Access to portions of the Forest could be inhibited in those 19 locations if a Forest visitor attempts travel at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term (8 to 23 months), direct irretrievable interruption to public access and therefore to dispersed recreation.

Indirect Effects

No indirect effects would be expected under Alternative 3.

Irreversible Effects

No irreversible effects would be expected under Alternative 3.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect developed recreation. No activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create cumulative effects to dispersed recreation.

3.8 ISSUE 7B: DEVELOPED RECREATION

Within the project area, there are two developed campgrounds (Reva Gap and Picnic Springs) and two concentrated use areas (CSU) (Deer Draw and Browns Pond). The Castles National Natural Landmark is accessed from Reva Gap Campground (USFS n.d.). Oil and gas development activities may affect developed recreation through changing what visitors see from these areas, what they hear while in these areas, and what they smell while there.

3.8.1 AFFECTED ENVIRONMENT

3.8.1.1 Recreation Opportunities and Use at Developed Sites

The landscape in Harding County is magnificent; cooling breezes through the pines, birds in flight, and the hand of humans is not at all obvious or obtrusive. Hunters who come to the area in the fall are the primary users, for both hunting and camping. Local residents use the area for picnicking, family reunions, weddings, school outings, and other private parties (Leibert 1997).

Activities in the developed category are automobile travel, camping, and picnicking. Table 3.8-1 shows Recreation Visitor Days (RVDs) for 1990 to 1995.

Table 3.8-1. Visitor Days of Developed Recreation Use^{1,2}

Activity Grouping	1990	1991	1992	1993	1994	1995
Automobile Travel	2.0	3.5	2.0	1.0	1.0	1.0
Camping, Automotive	0.4	0.5	0.4	0.3	0.3	0.3
Camping, Trailer	0.3	0.5	0.3	0.3	0.3	0.3
Camping, Tent	0.2	0.3	0.2	0.3	0.3	0.3
Picnicking	0.6	0.6	0.6	0.5	0.5	0.5
TOTALS	3.5	5.4	3.5	2.4	2.4	2.4

¹A recreation visitor day is a 12-hour visit by one person.

²Units of measurement = RVD's x1,000

Source: USFS Recreation Inventory and Management Report 1990-95

Automobile travel is the largest developed use, with picnicking second and camping third. The trees on the island hills attract local people from the prairie. Local residents are proud of the area and have said that they enjoy picnicking and showing the area to visiting friends and relatives (Leibert 1997). Approximately 27 percent of recreation use in the CNF is in developed sites. These include public facilities such as campgrounds, picnic areas, and observation sites. Most developed recreation sites are located in areas with shade trees and near water sources, used for fishing, swimming, and water play.

Existing facilities and improvements at developed sites such as access roads, parking spurs, picnic tables, stoves, campfire rings, toilets, etc., are in states of disrepair. Many existing developed recreation sites and facilities do not meet federal standards for accessibility per the Americans with Disabilities Act (ADA).

3.8.1.2 Affected Environment by Unit

North Cave Hills

The North Cave Hills unit (14,547 acres) is located in the northern part of the Sioux Ranger District near the state borders of South Dakota, North Dakota, and Montana, approximately 30 miles north of the town of Buffalo, SD. Within the North Cave Hills unit, there are 45 miles of roads and one developed campground (Picnic Springs), which has seven campsites along with roads, parking spurs, and toilets. Flowing springs are an integral part of this campground and are the reason the site was originally developed. However, the existing improvements are not in good shape. Most are of Civilian Conservation Corps vintage (1940s) and are in need of replacement. Browns Pond, a popular fishing area, has recently been purchased by the National Forest System.

Picnic Springs Campground is located within Management Area F-Developed Recreation. See Visual Resources Figure 3.4-2 for the location of the MA.

Table 3.8-2. Management Area F, Acres, and Prescribed Recreation Standards in the North Cave Hills

Management Area	Acres	Prescribed Recreation Standards
F - Developed Recreation	30	<ul style="list-style-type: none"> The recreation setting will vary among the developed sites from Semi-Primitive, Motorized, Roaded-Natural, and Rural. Sites will be characterized by predominantly natural or natural-appearing environments to a substantially modified natural environment. <p>Oil and Gas Development</p> <ul style="list-style-type: none"> Mitigation measures may include actions such as timing, seasonal or location restrictions. Design of features will meet Visual Quality Objectives. A No Surface Occupancy lease stipulation will be applied to all developed recreation sites. A Surface Occupancy Restriction (timing) stipulation will be applied to all new oil and gas leases within one-quarter mile of developed sites from May 15 to September 15.

There are two large areas, one to the north (2,423 acres) and another in the center (358 acres), totaling 2,784 acres of existing oil and gas leases within the North Cave Hills unit. There are currently three wells, two oil and one injector, within these leasing areas. All three wells are located at least one mile away, are within Management Area E—Minerals Management, and do not interfere with developed recreational activities.

South Cave Hills

The South Cave Hills unit (8,876 acres) is located south of the North Cave Hills unit and is the closest to the town of Buffalo (approximately 12 miles to the south). There are approximately 29 miles of roads and 10 miles of unimproved roads. There are no developed fishing, camping, or picnicking sites.

There are currently 1,623 acres of existing oil and gas leases within South Cave Hills, along the southern border. There are currently two existing wells within the boundaries of these leasing areas. One well is located within Management Area B–Rangeland, the other well is located off of NFS lands. Neither well interferes with dispersed recreational activities.

Slim Buttes

The Slim Buttes unit (46,972 acres) is located approximately 15 miles east of the town of Buffalo, SD. It runs north/south for approximately 25 miles and east/west for approximately 5 to 20 miles. The Castles National Natural Landmark is located within this unit and will be addressed in DEIS Section 3.16. There are approximately 105 miles of roads and 45 miles of unimproved roads. This unit contains one developed campground (Reva Gap), and three points of interest (the Castles NNL, Jesse Elliot Ranger Station, and Summit Pass). There is one designated fishing reservoir at Rabbit Creek Dam. There are also numerous springs and small reservoirs available for limited dispersed recreation. Eight high points are located within this unit. Saddle Point (elev. 1090) is accessible by an unimproved road. South Divide Road, approximately five miles, is a designated OHV road.

The Slim Buttes has one developed site, Reva Gap, which was originally a campground but was converted to a picnic area in 1974. It is located on State Highway 20. Reva Gap has four picnic sites and flowing springs, one of the reasons the site was originally developed. However, the existing improvements at this site are not in good shape. Most are of Civilian Conservation Corps vintage (1940s) and are in need of replacement.

The allocated Management Areas (MAs) within the Slim Butte Hills unit are identified in Table 3.8-3. See Visual Resources Figure 3.4-4 for the location of the MAs.

There are no existing oil and gas leasing areas within the Slim Buttes unit.

Table 3.8-3. Management Areas, Acres, and Prescribed Recreation Standards in the Slim Buttes

Management Area	Acres	Prescribed Recreation Standards
F – Developed Recreation	119	<ul style="list-style-type: none"> The recreation setting will vary among the developed sites from Semi-Primitive, Motorized, Roaded-Natural, and rural. Sites will be characterized by predominantly natural or natural-appearing environments to a substantially modified natural environment. <p>Oil and Gas Development</p> <ul style="list-style-type: none"> Mitigation Measures may include actions such as timing, seasonal or location restrictions. Design of features will meet Visual Quality Objectives. A No Surface Occupancy lease stipulation will be applied to all developed recreation sites. A Surface Occupancy Restriction (timing) stipulation will be applied to all new oil and gas leases within one-quarter mile of developed sites from May 15 to September 15.
O – National Natural Landmark	849	<ul style="list-style-type: none"> The recreation setting will be Roaded Natural. Road and interpretive signing will be used to inform the public about the Castles National Natural Landmark.

West Short Pines

The West Short Pines unit (1,264 acres) is located approximately 10 miles south of Camp Crook, SD. There are approximately 3.6 miles of roads and 2 miles of unimproved roads. There are three springs but no high points available for dispersed recreational activities. It is a small area in terms of overall available recreation areas but it is the closest NFS land to Camp Crook.

The north end of this unit has an existing oil and gas lease area of 153 acres but there are no existing wells. There is a drill hole on the south end of the unit. Neither the lease area nor the drill hole would interfere with existing developed recreation.

East Short Pines

The East Short Pines unit (6,147 acres) is located approximately 20 miles south and 5 miles east of Buffalo, SD. There are approximately 12 miles of roads, 6 miles of unimproved roads, no designated trails, and no developed fishing, camping, or picnicking sites. There are several springs and two high points available for dispersed recreational activities.

There are currently no existing oil and gas leases within the East Short Pines unit.

Surrounding Area

There are several other nearby public land areas available for dispersed recreation including large tracts of BLM land in southeast Montana. The Long Pines, Ekalaka Hills, and Chalk Buttes in southeast Montana are also part of the Sioux Ranger District and provide comparable settings and opportunities for recreation. These other areas, however, do not have the rock formations that are located within the project area.

3.8.2 ENVIRONMENTAL CONSEQUENCES**3.8.2.1 Alternative 1 - No Action, No New Leases**

No additional Forest System lands would be leased for oil and gas development under the No Action Alternative. However, any lands within existing lease areas could be further developed for oil and gas activities consistent with existing lease rights. This could include construction of new roads, pads, pipelines, and other oil and gas exploration and development activities. Impacts from past and present projects would continue and possible expansion of activities and facilities within existing lease areas could cause additional impacts.

North Cave Hills

Under the No Action Alternative RFD projections, two additional wells would be located within existing lease units. These wells would be located approximately two miles from Picnic Spring Campground, therefore there are no expected direct effects. Additional truck and worker traffic in the area would represent short-term, indirect effects for approximately one month during exploration and construction. This additional traffic could be routed to avoid the road adjacent to Picnic Springs.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These oil and gas development

activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, irreversible, long-term or cumulative effects on developed recreation are expected under the No Action Alternative within the North Cave Hills unit.

South Cave Hills

Under the No Action Alternative, three additional wells would be located within existing lease units. Since there are no developed recreation areas within the South Cave Hills unit, no effects would occur.

Slim Buttes

Under the No Action Alternative, no leasing activity would occur within the Slim Buttes unit since there are no existing leases. Therefore, no effects would occur.

West Short Pines

Under the No Action Alternative, no leasing activity would occur within the West Short Pines unit since there are no existing leases. Therefore, no effects would occur.

East Short Pines

Under the No Action Alternative, no leasing activity would occur within the East Short Pines unit since there are no existing leases. Therefore, no effects would occur.

Direct Effects

Under the No Action Alternative, five new wells are projected to be constructed. Two of the projected new wells would be located near Picnic Springs Campground in the North Cave Hills. Access by recreationists to this campground could be inhibited if a forest visitor attempts travel on a NFS Road leading to the campground at the same time as oil and gas-related trucks or commuting workers. Additionally, if these forest visitors expect an isolated experience, they could have a diminished experience due to additional traffic on NFS Roads resulting from oil and gas leasing activities. Visitor perception of increased construction traffic could affect their experience. The temporary effects during construction represent a short-term (two to six months), direct, irretrievable interruption to developed recreation.

Indirect Effects

Indirect effects are addressed under *Cumulative Effects*.

Irreversible Effects

No irreversible effects are expected under the No Action Alternative.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect developed recreation. No activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create direct cumulative effects to developed recreation.

Harding County has just completed the Cave Hills road improvement project. No other projects by the county are planned within the oil and gas leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the amount of activity on State lands that would require permits through their office but not many are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects are expected as a result of these projects.

The State Land commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users regarding this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects are expected from the No Action Alternative in addition to these other activities.

3.8.2.2 Alternative 2 - Lease with Forest Plan Stipulations

All five land units would be leased with the stipulations specified in the Custer Forest Plan (p. 169-173).

North Cave Hills

Under Alternative 2, 12 new wells are projected within the North Cave Hills unit. Some of these wells could be located off of National Forest System (NFS) lands. These projected wells would be located from approximately one to four miles from Picnic Spring Campground; therefore, there are no expected direct effects. Additional truck and worker traffic in the area would represent short-term, indirect effects for approximately 4 to 12 months during exploration and construction. This additional traffic could be routed to avoid the road adjacent to Picnic Springs.

In a worst-case scenario, disruption to hunting could occur for approximately 4 to 12 months if construction and exploration took place during hunting seasons. These oil and gas development activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, irreversible, long-term or cumulative effects on developed recreation are expected.

South Cave Hills

Under Alternative 2, 10 new wells are projected within the South Cave Hills unit. These projected wells would not be located within the vicinity of any developed recreation management areas; therefore, no direct or indirect effects are expected within this unit.

Scenic viewing could be temporarily disrupted during exploration and construction, but this would not result in a substantial effect. No substantial direct, irreversible, long-term or cumulative effects on developed recreation are expected.

Slim Buttes

Under Alternative 2, three new wells are projected within the Slim Buttes unit. These projected wells would not be located within any developed recreation area, and could be located off of NFS lands. Therefore, no direct effects on developed recreation are expected. Additional truck and worker traffic in the area would represent short-term, indirect effects for approximately one month during exploration and construction. This additional traffic would occur on the road adjacent to the Reva Gap Picnic Area, the Castles National Natural Landmark, and three points of interest, and therefore could be disruptive to tourism. However, the most recent number of RVDs to these sites indicate a low number of visitors, and therefore no substantial effect is expected.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These oil and gas development activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, irreversible, long-term or cumulative effects on developed recreation are expected.

West Short Pines

Under Alternative 2, two new wells are projected within the West Short Pines unit. These projected wells would not be located within the vicinity of any developed recreation management areas; therefore, no direct or indirect effects are expected within this unit.

Scenic viewing could be temporarily disrupted during exploration and construction, but this would not result in substantial effects. No substantial direct, irreversible, long-term or cumulative effects on developed recreation are expected.

East Short Pines

Under Alternative 2, one new well is projected within the East Short Pines unit. This projected well would not be located within the vicinity of any developed recreation management areas; therefore, no direct or indirect effects are expected within this unit.

Scenic viewing could be temporarily disrupted during exploration and construction, but this would not result in substantial effects. No substantial direct, irreversible, long-term or cumulative effects on developed recreation are expected.

Direct Effects

No direct effects to developed recreation sites are expected under Alternative 2.

Indirect Effects

Under Alternative 2, 15 new wells would be constructed near enough to developed recreation areas that some disruption to recreational traffic could be expected. Additional truck and worker traffic in the area would represent short-term, indirect, irretrievable effects for approximately 5 to 15 months during exploration and construction near Picnic Springs Campground. Additional traffic would occur on the road adjacent to the Reva Gap Picnic Area, the Castles National Natural Landmark, and three points of interest, and therefore could be disruptive to tourism.

Irreversible Effects

No irreversible effects are expected under Alternative 2.

Irretrievable Effects

Irretrievable effects are described under *Indirect Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect developed recreation. No activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create direct cumulative effects to developed recreation. Cumulative effects to developed recreation within the Sioux Ranger District would not be substantial. A low level of impacts to scenic driving and developed site visitation could occur during exploration and construction due to increased truck and worker traffic. These disruptions, such as waiting for trucks to turn off roads or highways, would be for a short

duration (approximately one month), and could be timed so as not to coincide with hunting seasons.

3.8.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

Environmental effects to developed recreation sites would be similar to effects described under Alternative 2. Additional lease stipulations would eliminate three wells from consideration, for a total of 19 new wells. The additional stipulation would not be triggered by effects to developed recreation.

North Cave Hills

Under Alternative 3, the entire North Cave Hills land unit would be under a NSO stipulation to protect cultural resources. As a result, seven of the projected RFD wells are eliminated and the remaining five projected wells would be located off of NFS lands. These wells would need to be close enough to the Forest boundary to access the subsurface resource by horizontal or slant drilling. Since the wells would be off-Forest they would be at a lower elevation in the grasslands below the mesas and thus not directly affect Picnic Spring Campground. Additional truck and worker traffic in the area could represent short-term, indirect effects for approximately three to seven months during exploration and construction. This additional traffic could be routed to avoid the road adjacent to Picnic Springs.

In a worst-case scenario, disruption to hunting could occur for approximately one to three months if construction and exploration took place during hunting seasons. These oil and gas development activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact.

South Cave Hills

Under Alternative 3, nine new wells are projected within the South Cave Hills unit. These projected wells would not be located within the vicinity of any developed recreation management areas; therefore, no direct or indirect effects are expected within this unit. Scenic viewing could be temporarily disrupted during exploration and construction, but this would not result in a substantial effect.

Slim Buttes

Under Alternative 3, the entire Slim Buttes land unit would be under a NSO stipulation to protect cultural resources. As a result, two of the projected RFD wells are eliminated and the remaining two projected wells would be located off of NFS lands. These wells would need to be close enough to the Forest boundary to access the subsurface resource by horizontal or slant drilling. There could be a low level of traffic impacts to recreation users en route to the Forest. Additional land used for the two projected wells would be approximately 11 acres. Additional truck and worker traffic in the area would represent short-term, indirect effects for approximately one month during exploration and construction. This additional traffic could occur on the road adjacent to the Reva Gap Picnic Area, the Castles National Natural Landmark, and three points

of interest, and therefore could be disruptive to tourism. However, the most recent number of RVDs to these sites indicates a low number of visitors, and therefore no substantial effect is expected.

In a worst-case scenario, disruption to hunting could occur for approximately one month if construction and exploration took place during hunting seasons. These oil and gas development activities could be timed so as not to coincide with hunting seasons and therefore mitigate short-term effects on hunting. Any negative effects to scenic viewing would also be temporary (during exploration and construction), and therefore would not represent a substantial impact. No substantial direct, irreversible, long-term, or cumulative effects on developed recreation are expected.

West Short Pines

Under Alternative 3, two new wells are projected within the West Short Pines unit. This is the same number of wells projected under Alternative 2. These projected wells would not be located within the vicinity of any developed recreation management areas; therefore, no direct or indirect effects are expected within this unit.

Scenic viewing could be temporarily disrupted during exploration and construction, but this would not result in substantial effects.

East Short Pines

Under Alternative 3, one new well is projected within the East Short Pines unit. This is the same number of wells projected under Alternative 2. This projected well would not be located within the vicinity of any developed recreation management areas; therefore, no direct or indirect effects are expected within this unit.

Scenic viewing could be temporarily disrupted during exploration and construction, but this would not result in substantial effects.

Direct Effects

No direct effects to developed recreation sites are expected under Alternative 3.

Indirect Effects

Under Alternative 3, one new well could be constructed near enough to developed recreation areas that some disruption to recreational traffic could be expected. Additional truck and worker traffic in the area would represent short-term, indirect, irretrievable effects for approximately one month during exploration and construction near Picnic Springs Campground. Additional traffic would occur on the road adjacent to the Reva Gap Picnic Area, the Castles National Natural Landmark, and three points of interest, and therefore could be disruptive to tourism.

Irreversible Effects

No irreversible effects are expected under Alternative 3.

Irretrievable Effects

Irretrievable effects are described under *Indirect Effects*.

Cumulative Effects

Cumulative effects include potential effects of oil and gas leasing activities combined with the effects from other activities within the Sioux Ranger District and Harding County that could affect developed recreation. No activities have been identified by the USFS, Harding County, the State Lands Dept., or the BLM that would create direct cumulative effects to developed recreation.

3.9 ISSUE 8: SOIL RESOURCES

Oil and gas exploration, development, and production may adversely affect soil properties such as productivity, permeability, and erodability. Potential effects include mass wasting, increased sediment generation, and compaction.

Forest Plan Direction for Soil Resources includes the following (USFS 1987, p. 25):

Soil and water resources will be managed to maintain or improve quality of watershed, including soil productivity and water quality. Best Management Practices will be applied to project activities to assist in meeting or exceeding state water quality standards (see FSH 2509.22).

Regional soil quality standards from the Forest Service Manual Supplement 2500-99-1 (USFS 1999) define the criteria for evaluating soil disturbance:

Policy for Controlling Soil Disturbance: Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent. In areas where more than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality.

Also: Soil quality standards apply to lands where vegetation and water resource management are the principal objectives, that is, timber sales, grazing pastures or allotments, wildlife habitat, and riparian areas. The standards do not apply to intensively developed sites such as mines, developed recreation sites, administrative sites, or rock quarries. They are not intended to prohibit other resource management practices such as, installing waterbars or preparing sites for planting, as long as such practices are consistent with long-term sustainability of the soil resource. Permanent roads do affect soil-hydrologic function, however, their evaluation is more appropriately done on a watershed basis using models and other watershed analysis techniques.

This is a Region wide standard that was developed to insure that soil disturbance would not substantially reduce soil productivity.

3.9.1 AFFECTED ENVIRONMENT

3.9.1.1 Background

The soils in the project area developed in Upper Cretaceous and Tertiary geologic rock formations, resulting in a variety of soil depths and textures. In flatter areas of the project area, shale, mudstone, and soft sandstone of the Upper Cretaceous form soils that have salt

accumulations at 6 to 12 inches. Very slow permeability, in combination with salt accumulations, inhibits plant growth, especially if the topsoil is removed or disturbed.

The Tertiary geologic formations in the project area are mixtures of hard and soft sandstone that form a more dissected, rocky landscape of flat-topped mesa and buttes with steep and very steep side slopes and drainage ways. The parent materials give rise to gravelly, rocky, sandy, and loamy soils with moderate to rapid permeability. If the ground cover is lost on these soils, wind and water erosion can cause gullies, particularly when trails or roads are not drained adequately (USDA Natural Resources Conservation Service [NRCS] 1984).

Soil productivity in the project area ranges from moderate to low. Plant growth is severely restricted by the salt content in some of soils and a majority of the soils have sandy textures and/or high rock content that result in low available water for plant growth. As a result, vegetation is limited to grassland species in most of the project area. Compaction reduces productivity on the soils with high salt content (NRCS 1984).

Landscapes with slopes over 40 percent have an increased potential for surface erosion because of the increased velocity of runoff (Table 3.9-2). Soil slumps, unstable conditions, and gully erosion can be problematic on road-cut embankments and fills, particularly on steep slopes.

3.9.1.2 Criteria for Analyzing Soil and Landscape Conditions

The criteria presented in Table 3.9-1 were used to identify fragile soil and landscape conditions in the project area using GIS analysis.

Many of the soil map units in the Soil Survey of Harding County, South Dakota (NRCS 1984) are a combination of soil associations and soil complexes that include both fragile and non-fragile soils. Map units in which fragile soils were dominant (greater than 50 percent of the unit) were identified as fragile. Map units in which the fragile soils were not dominant were not identified as fragile, under the assumption that there would be sufficient non-fragile land area to allow siting of well pads.

Table 3.9-1. Criteria for Describing Fragile Soil and Landscape Conditions

Condition	Criteria Used in Identification
Slopes exceeding 40 percent	Identified using GIS.
Fragile soils were interpreted to be soils with one or more of these characteristics (NRCS 1984)	Water erosion T ratings of 1 or 2 (tons of soil loss that would affect productivity)
	Wind erosion ratings of very severe and severe
	Soil map units with severe geologic erosion
	Soils with Slickspots (areas devoid of vegetation due to high salt content in soil)
	Areas with severe geologic erosion
	Areas of mining spoils
Mass failure hazard	GIS landtype map. (Map Unit P12-R1-Landslides.) Construction activities on landslides could activate mass failures of side slopes

3.9.1.3 Soil and Landscape Condition and Disturbance in Land Units

There were 19 soil map units that were identified as fragile soils using the criteria described in Table 3.9-1. The fragile soils are identified as Slickspots, Soil Erosion, Severe Geologic Erosion, and Mine Spoil. Three overlapping GIS layers (slope, soils, and landtype) were used to estimate fragile soil and landscape conditions. This resulted in six classes to display current soil resource and landscape conditions: Slopes greater than 40 percent, Slickspots, Soil Erosion, Severe Geologic Erosion, Mining Spoils, and Mass Failure Hazard. Soil and landscape conditions (acres) for each land unit are provided in Table 3.9-2.

Table 3.9-2. Fragile Soils and Landscapes in the Project Area (acres)

Land Unit	Slopes Greater Than 40 Percent	Fragile Soils					Mass Failure Hazard	Subtotal	Non- Fragile Soils & Land- scapes	Total
		Slick- spots	Soil Erosion	Severe Geologic Erosion	Mining Spoils					
North Cave Hills	3,680	0	6,525	0	258	0	10,462	4,085	14,547	
South Cave Hills	2,035	0	4,311	0	8	0	6,354	2,522	8,876	
Slim Buttes	9,447	20	16,484	6,446	6	296	32,699	14,273	46,972	
West Short Pines	298	0	1	57	0	0	356	907	1,263	
East Short Pines	1,418	1	1,203	411	0	0	3,033	3,114	6,147	
Total	16,878	21	28,523	6,914	271	296	52,904	24,901	77,805	

North Cave Hills

Seventy-two percent of this land unit has fragile soil and landscape conditions. Figure 2.29 provides a map of these conditions and shows the location of wells. There are three existing wells. One developed well is on non-fragile soils and one injection well is located on a fragile soil erosion area in the north leasing block. The third, a developed well, is on non-fragile area in the central leasing block. Also, a sediment pond is being constructed in this land unit. Existing disturbance from wells is approximately 15 acres.

South Cave Hills

Seventy-two percent of this land unit has fragile soil and landscape conditions. Figure 2.30 provides a map of these conditions and the locations of existing roads and wells. There are two existing wells, one located on a fragile soil erosion area and one off-forest. Existing disturbance from wells is approximately 10 acres.

Slim Buttes

Seventy percent of this unit has fragile soil and landscape conditions. Figure 2.31 provides a map of these conditions and the location of existing roads. There are no existing wells in this land unit. A fuel hazard abatement project is being proposed along both sides of NFSR 3214. This will involve pre-commercial thinning along both sides of the road for 1.5 miles.

West Short Pines

Twenty-eight percent of this unit has fragile soil and landscape conditions. Figure 2.32 provides a map of these conditions and the location of existing roads. There are no existing wells in this land unit.

East Short Pines

Forty-nine percent of this unit has fragile soil and landscape conditions. Figure 2.33 provides a map of these conditions and the location of existing roads. There are no existing wells in this land unit.

Summary

The existing disturbance of wells is less than one percent of the land units, which falls well below the regional soil quality standards for soil disturbance (15 percent).

3.9.2 ENVIRONMENTAL CONSEQUENCES

3.9.2.1 Direct and Indirect Effects Common to All Alternatives

Potential direct and indirect effects on soil resource productivity are surface disturbances at well sites, road construction for access to well pads, spills during drilling, leaks from piping and storage tanks, and spills during petroleum transfer operations.

Soil productivity can be altered by surface soil loss, compaction, and exposing naturally salty subsoil during construction. Spilling saltwater during well drilling could inhibit plant growth in the areas affected. Effects on soils will be minimized by following Best Management Practices (BMPs) (USFS 1988) and Soil Quality Standards (USFS 1999); and where reclamation, revegetation, and erosion control measures are implemented and are successful (Appendix E).

The potential for slope failure increases for major excavations requiring extensive cut-and-fill operations. Excavation of pipeline trenches alters soil profiles, and can bring boulders and salty, poorly productive subsoil to the surface resulting in revegetation and restoration difficulties. If routes can be placed on gentle slopes, the amount of cuts and fills will be reduced. Reduction in the amount of disturbance relates to the amount of soil erosion and loss of site productivity (USFS 1994). Implementation of erosion control and revegetation measures immediately following disturbance would reduce the amount of erosion (USFS 1988). Under most situations, accelerated soil erosion and productivity losses would occur until pipeline rights-of-way are stabilized (two to five years). This is considered a short-term impact.

Historic impacts on soil and landscape condition from fire, livestock grazing, plowing on sagebrush, woodcutting, and hunting are assumed to have been proportionate across all land ownerships.

3.9.2.2 Alternative 1 - No Action, No New Leases

This Alternative is a projection of the current management situation. No new leases would be granted; only existing leases held by producing wells would be allowed to continue past

expiration of the current lease term. The RFD projects there could be five new wells developed within existing lease boundaries.

North Cave Hills

There are two RFD wells projected for this unit (one developed and one injection), which would bring the total land disturbance from wells to 25 acres of long-term (26 acres short-term). These new wells can be located on non-fragile soil and landscape areas.

South Cave Hills

There are three RFD wells projected for this unit (two developed and one injection), which would bring the total land disturbance from wells to 25 acres long-term (27 acres short-term). These new wells can be located on non-fragile soil and landscape areas.

Slim Buttes, West Short Pines, and East Short Pines

There are no new wells planned for these land units.

Direct and Indirect Effects

Given the limited and projected future oil and gas disturbance in the land units, direct effects of this alternative are expected to be negligible. Total soil disturbance is less than one percent for both North Cave Hills and South Cave Hills, which is well below the regional standard for protecting soil quality. The new wells can be sited so they would not be located on fragile soils and landscapes. Best Management Practices (USFS 1988) and Soil Quality Standards (USFS 1999) will be applied and monitored. The small amount of additional disturbance is not expected to cause substantial loss to soil productivity of the land units. The Custer National Forest has a Contingency Plan for use and direction in the event of a serious oil or gas spill.

Cumulative Effects

For soil resources, effects on soil productivity are generally localized and do not accumulate across the landscape. An area of disturbed soil does not affect overall soil productivity in other areas. There are no soil standards that apply across management boundaries, so soil-disturbing activities that occur outside NFS lands are not included in the criteria for measuring effects on the productivity of soils within the project area.

Ongoing projects within the project area have not changed markedly over the past years. These include existing oil and gas leasing, grazing, reclamation of uranium mines, cleaning out sediment ponds, suppression of wildfires, hunting, and recreation. A fuel break is planned in the Slim Buttes land unit. Since future projects will undergo environmental analysis, with effects being addressed and controlled by Best Management Practices and Soil Quality Standards, adverse cumulative effects to soil resources are not expected.

Irreversible/Irretrievable Effects

Under this Alternative, there would be approximately 25 acres of additional long-term commitment of soils to oil and gas development activities compared to the existing condition, for a total of 50 acres.

3.9.2.3 Alternative 2 - Lease with Forest Plan Stipulations

This alternative would allow oil and gas leasing with stipulations specified in the Forest Plan (USFS 1987, p. 169-174) in addition to the standard BLM Standard Lease Terms (SLT).

Stipulation for Soil Resources

Potential adverse effects to soil resources from oil and gas leasing would be mitigated through lease stipulations that restrict the location or timing of lease-related activities. The Forest Plan Appendix V (USFS 1987, p. 169-174), as amended, lists oil and gas leasing stipulations for each management area. There is one soil resources stipulation that applies:

Stipulation 1. No Surface Occupancy on slopes exceeding 40 percent, fragile soils, and/or mass failure hazard in Management Areas B, D, and E. (USFS 1987, amendment 29.)

Area Affected by Stipulations

The current Forest Plan applies Stipulation 1 criteria to Management Areas B, D, and E (USFS 1987, p. 169-174). Although additional stipulations may apply to other management areas to protect other Forest resources, Alternative 2 allows activities related to oil and gas development to occur on slopes greater than 40 percent, fragile soils, and unstable soils outside Management Areas B, D, and E. Table 3.9-3 lists the amount of fragile areas by land unit that would be unavailable for leasing due to Stipulation 1 under Alternative 2.

Table 3.9-3. Area and Type of Land Covered by NSO Stipulation 1 in Management Areas B, D, and E for Alternative 2 (acres)

Land Units	Stipulation 1 Criteria						Subtotal	Total Area of Land Unit
	Slopes Greater Than 40 Percent	Fragile Soils				Mass Failure Hazard		
		Slick-spots	Soil Erosion	Severe Geologic Erosion	Mining Spoils			
North Cave Hills	1,958	0	5,319	0	243	0	7,520	14,547
South Cave Hills	1,164	0	3,657	0	8	0	4,829	8,876
Slim Buttes	6,580	20	13,106	3,799	6	259	24,792	46,972
West Short Pines	228	0	1	37	0	0	296	1,263
East Short Pines	900	1	950	134	0	0	1,986	6,147
Total	10,861	21	24,055	3,688	256	259	39,423	77,805

Alternative 2 could allow oil and gas leasing on up to 13,482 acres of fragile soils, slopes greater than 40 percent, and soils with mass failure hazard. Although the actual amount of land that would be open to leasing would be less due to other stipulations and constraints, this alternative allows for development on areas that increase the risk of development on fragile soils and landforms. Table 3.9-4 lists the area of disturbance from the RFD wells projected under Alternative 2.

Table 3.9-4. Alternative 2 Soil Resources Disturbance

Land Unit	Disturbance (acres)						
	Total RFD Wells	Short-Term RFD	Long-Term RFD	Existing	Total Short-Term	Total Long-Term	Total Long-term Percent
North Cave Hills	12	68	60	15	83	75	0.5
South Cave Hills	10	57	50	10	67	60	0.7
Slim Buttes	3	17	0	0	17	0	0
West Short Pines	2	11	5	0	11	5	0.4
East Short Pines	1	6	0	0	6	0	0

North Cave Hills

This unit has the most projected development out of all of the land units, with a total of 83 acres (including existing disturbance) of short-term disturbance from RFD oil and gas development, and 75 acres of long-term disturbance. The total long-term soil disturbance is less than one percent of the land unit. None of the RFD wells projected under Alternative 2 are located on fragile soils.

South Cave Hills

This unit has a total of 67 acres of short-term disturbance (including existing disturbance) from the projected RFD activities, with 60 acres of long-term disturbance. The total long-term soil disturbance is less than one percent of the land unit. None of the RFD wells projected under Alternative 2 are located on fragile soils.

Slim Buttes

This unit has 17 acres of short-term disturbance from the projected RFD activities. The three RFD wells are estimated to be dry holes, so there would be no change in long-term disturbance once the dry hole sites are rehabilitated. None of the RFD wells projected under Alternative 2 are located on fragile soils.

West Short Pines

This unit has 11 acres of short-term disturbance from the projected RFD activities. One of the RFD sites is projected to be a dry hole and would be rehabilitated. The total long-term disturbance is five acres, less than one percent of the area. None of the RFD wells projected under Alternative 2 are located on fragile soils.

East Short Pines

This unit has six acres of short-term disturbance from the projected activities. The one RFD well is estimated to be a dry hole, so there would be no change in long-term disturbance once the dry hole site is rehabilitated. This projected well is not located on fragile soils.

Direct and Indirect Effects

The RFD is an estimate of potential oil and gas leasing activities, and is used to analyze the potential effects associated with those activities. Since it is only an estimate, it is not sufficient for project-level or site-specific analysis. It represents the level of development that is likely to occur, rather than a specific plan for development. For Alternative 2, it is assumed that if an RFD well or road occurs on an area included in Stipulation 1, it would be relocated to an area outside the stipulation zone. Therefore, all of the potential soil disturbance from projected wells would occur within the respective land unit, but potentially at a different location. Under Alternative 2, Stipulation 1 only applies to management areas B, D, and E. While different stipulations to protect other resources may apply in other management areas, there are still portions of other management areas that have slopes over 40 percent, fragile soils, and areas prone to mass wasting where oil and gas leasing could occur. However, all RFD wells can be sited so that they are not located on fragile soils and landscapes. Any projected wells that could not be relocated were eliminated.

The small amount of additional disturbance is not expected to cause substantial loss to soil productivity of the land units. The projected disturbance ranges from 0.4 to 0.7 percent of the land units, which is well below the regional standard for protecting soil quality. All of the projected RFD sites can be located to avoid impacting fragile soils and landscapes. Best Management Practices (USFS 1988) and Soil Quality Standards (USFS 1999) will be applied and monitored. The Custer National Forest has a Contingency Plan for use and direction in the event of a serious oil or gas spill.

Cumulative Effects

For soil resources, effects on soil productivity are generally localized and do not accumulate across the landscape. An area of disturbed soil does not affect soil productivity in other areas. There are no soil standards that apply across management boundaries, so soil-disturbing activities that occur outside NFS lands are not included in the criteria for measuring effects on the productivity of soils within the project area.

Ongoing projects within the project area have not changed markedly over the past years. These include existing oil and gas leasing, grazing, reclamation of uranium mines, cleaning out sediment ponds, suppression of wildfires, hunting, and recreation. A fuel break is planned in the Slim Buttes land unit. Since future projects will undergo environmental analysis, with effects being addressed and controlled by Best Management Practices and Soil Quality Standards, adverse cumulative effects to soil resources are not expected.

Irreversible/Irretrievable Effects

Under this Alternative, there would be approximately 115 acres of additional long-term commitment of soils to oil and gas development activities compared to the existing condition, for a total of 140 acres.

3.9.2.4 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

In this alternative, the entire area of fragile soils and landscapes (as shown in Table 3.9-2) would be excluded from oil and gas development.

Soil map units with less than 50 percent fragile soils and landscapes were classified as non-fragile for this analysis. However, these map units may contain some fragile soil areas. Potential adverse effects to soil resources from oil and gas leasing would be mitigated through the following additional controlled surface use (CSU) stipulations:

FRAGILE SOILS: When physically locating well pads and roads, an on-the-ground determination shall be made of the exact location of fragile soils, and the well shall be sited so that the fragile soil will not be affected.

TOPSOIL: Topsoil shall be stockpiled and reused in rehabilitation of disturbed sites to maintain soil productivity.

Table 3.9-5 lists the area of disturbance from the RFD wells projected under Alternative 3.

Table 3.9-5. Alternative 3 Soil Resources Disturbance

Land Unit	Disturbance (acres)					Total Short-Term	Total Long-Term	Total Long-term Percent
	Total RFD Wells	Short-Term RFD	Long-Term RFD	Existing				
North Cave Hills	5	25	15	15	44	40	0.3	
South Cave Hills	9	51	45	10	61	55	0.6	
Slim Buttes	2	11	0	0	11	0	0	
West Short Pines	2	11	5	0	11	5	0.4	
East Short Pines	1	6	0	0	6	0	0	

Table 3.9-6 lists the difference in area available for oil and gas development between Alternative 2, which limits Stipulation 1 to management areas B, D, and E according to the Forest Plan, and Alternative 3, which adds an additional stipulation requiring the NSO stipulation be applied to all NFS lands with slopes greater than 40 percent, fragile soils, and soils with a mass failure hazard.

Table 3.9-6. Difference between Alternative 2 (Stipulation 1 Criteria are applied to Management Areas B, D, and E) and Alternative 3 (Stipulation 1 criteria applied to all NFS land)

Land Unit	Alternative 2 Fragile Soils NSO only on Mgmt Areas B, D, & E¹ (acres)	Alternative 3 Fragile Soils NSO on all NFS Land (acres)	Difference in Area Protected by Alt 3 NSO Stipulations (acres)	Percent Difference in Additional Land Unit Protected by Alt 3 NSO Stipulations (percent)
North Cave Hills	7,520	10,029	2,942	29
South Cave Hills	4,829	5,987	1,525	25
Slim Buttes	24,792	30,334	7,907	26
West Short Pines	296	300	60	20
East Short Pines	1,986	2,998	1,047	35
Total	39,423	52,904	13,481	25

¹USFS 1987, p. 169-174.

North Cave Hills

Under Alternative 3, this land unit is entirely NSO to protect cultural resources. As a result, seven of the RFD projected wells are eliminated and the other five have projected locations off-Forest. As a result, there are no soils effects on-Forest. An evaluation cannot be made of the effects of the wells off-Forest due to a lack of soils data and well location information.

South Cave Hills

This land unit has a total of 61 acres of short-term disturbance (one projected well less than under Alternative 2) from the projected RFD activities, with 55 acres of long-term disturbance. The total long-term soil disturbance is less than one percent of the land unit. None of the RFD wells projected under Alternative 3 are located on fragile soils.

Slim Buttes

Under Alternative 3, this land unit is entirely NSO to protect cultural resources. As a result, two of the RFD projected wells are eliminated and the other two have projected locations off-Forest. As a result, there are no soils effects on-Forest. An evaluation cannot be made of the effects of the wells off-Forest due to a lack of soils data and well location information.

West Short Pines

The disturbance is the same as under Alternative 2.

East Short Pines

The disturbance is the same as under Alternative 2.

Direct and Indirect Effects

The small amount of additional disturbance is not expected to cause substantial loss to soil productivity of the land units. This alternative would be more protective of fragile soils and landscapes by applying NSO restrictions to all management areas, not just B, D, and E as in Alternative 2, protecting an additional 13,481 acres. The projected disturbance ranges from 0.3

to 0.6 percent of the land units, which is well below the regional standard for protecting soil quality. All of the projected on-Forest RFD sites can be located to avoid impacting fragile soils and landscapes. Best Management Practices (USFS 1988) and Soil Quality Standards (USFS 1999) will be applied and monitored. The Custer National Forest has a Contingency Plan for use and direction in the event of a serious oil or gas spill. This alternative is not expected to have an adverse impact on soil resources.

Cumulative Effects

For soil resources, effects on soil productivity are generally localized and do not accumulate across the landscape. An area of disturbed soil does not affect soil productivity in other areas. There are no soil standards that apply across management boundaries, so soil-disturbing activities that occur outside NFS lands are not included in the criteria for measuring effects on the productivity of soils within the project area.

Irreversible/Irretrievable Effects

Under this Alternative, there would be approximately 75 acres of additional long-term commitment of soils to oil and gas development activities compared to the existing condition, making a total of 100 acres.

3.10 ISSUE 9: HYDROLOGIC RESOURCES

3.10.1 AFFECTED ENVIRONMENT

Oil and gas development may affect water resources including wetlands and riparian areas. Ground water may be affected by drilling wells, which could result in mixing water from one aquifer with that of another. Migration of salt water or water mixed with oil into aquifers used for potable water is of particular concern. Oil, hazardous materials, and other fluid could spill from production facilities, trucks, and pipelines and affect surface water quality, as well as other resource values.

3.10.1.1 Measuring Effects to Water Quality

Potential effects are discussed relative to the potential for increased sedimentation, the capacity to meet state water quality standards, and effects to wetlands.

Water quality effects are estimated by determining disturbance to water resources (streams, watersheds, and riparian areas) by roads and wells. Miles of roads, number of stream crossings, and acres of wells and roads are used as indicators of effects.

3.10.1.2 Forest Plan Direction

The following Forest Plan Management Direction for Water Resources is related to this issue (USFS 1987, p. 25-26):

1. *Soil and water resources will be managed to maintain or improve quality of watershed, including soil productivity and water quality. Best Management Practices (BMPs) will be applied to project activities to assist in meeting or exceeding state water quality standards (see FSH 2509.22).*
3. *The Forest will cooperate with . . . South Dakota to protect, conserve, and enhance water consistent with other land and resource management plan objectives, through the use of improved technology, cooperative planning and application of BMPs. Water originating on National Forest System lands will meet State Water Quality Standards except where it cannot be improved due to natural geologic conditions.*
5. *All freshwater aquifers will be protected from contamination by such things as oil and gas drilling and brine water injections. It is especially critical to protect the deep Fox Hills aquifer during oil and gas activities. Drillers must use fresh water until well below the Fox Hills formation; casings must be checked to assure integrity during production, injection and any other uses, for as long as the well exists.*

The following Forest Plan Management Direction for Oil and Gas Leasing is related to this issue (USFS 1987, p. 28):

- c) *The siting of oil and gas facilities and developments in sensitive areas identified in an environmental analysis will be discouraged and possibly prohibited,*

- especially in areas of mass failure hazard and along river bottoms and areas subject to high flooding hazard.*
- e) Drilling pads will be designed to divert surface water off of or away from the pad to minimize erosion and water accumulation.*
 - f) Salt water tanks will be located to minimize the potential for contamination due to a salt water spill.*
 - g) Oil and gas production facilities will be designed to contain potential oil and saltwater spills.*

The Custer National Forest has a Contingency Plan for use and direction in the event of a serious oil or gas emergency. The Plan is designed to protect the surface resources.

3.10.1.3 General Hydrologic Characteristics

The project area is located on the Cretaceous Table Lands with several prominent buttes rising above the surrounding landscape. The project area is located at the divide for tributaries draining into the Little Missouri, Grand, and Moreau Rivers. Land elevation ranges from 2,680 feet along the North Fork of the Moreau River (in the southwestern part of the project area), to 4,015 feet in the East Short Pines. The average annual precipitation for the region is 14.7 inches, of which approximately 80 percent falls in April through September (NRCS 1984). Thunderstorms occur approximately 42 days per year with the heaviest 1-day rainfall of 3.46 inches recorded on June 14, 1976. The average seasonal snowfall is approximately 40 inches. On average, 47 days of the year have at least one inch of snow on the ground. The greatest snow depth at any one time during the winter was 38 inches. Snow generally blows in drifts and some ground is free of snow. There are 98 to 135 days a year above 32 °F (NRCS 1984).

Stream flows are erratic, as most are intermittent in nature and carry water only in spring and after heavy rainfall (NRCS 1984). Surface water is lacking during most of the year. There are 5.3 miles of perennial and 243.1 miles of intermittent streams in the project area (Table 3.10-1). The principal sources of water for wildlife and livestock are intermittent streams, springs, impoundments of surface runoff, and shallow wells. According to the 1984 Soil Survey, 19.9 acres of water were impounded on the land units of the project area, Table 3.10-1 (NRCS 1984). Riparian habitat and woody draws are important in maintaining water quality because they serve as filtering areas for removal of sediment and other pollutants from surface flows. Litter and large woody debris provide ground cover that retards flood flows and protects the stream channels from bank and gully erosion. There are 372 acres of riparian habitat along channels (Table 3.10-1). The extent of woody draws is discussed in Section 3.1, Biological Diversity and is shown on Management Area Maps as Management Area M – Riparian.

Table 3.10-1. Some Hydrologic Characteristics of Land Units

Land Unit	Streams		Water Impoundments (ac.)	Riparian (ac.)
	Perennial (mi.)	Intermittent (mi.)		
North Cave Hills	0.2	38.0	5.5	103
South Cave Hills	1.6	20.3	1.3	88
Slim Buttes	3.5	160.5	13.5	169
West Short Pines	0.0	2.9	0	4
East Short Pines	0.0	21.4	0	8
Total	5.3	243.1	19.9	372

3.10.1.4 Beneficial Water Uses

The State has assigned beneficial water uses for designated portions of some tributaries of the major rivers in Harding County (Table 3.10-2). These beneficial uses serve as the standard for which water quality is measured.

3.10.1.5 Water Quality

Water quality within the project area has not been measured. None of the streams draining the project area are on the State 303(d) list published in 1998 (SD DENR 1998). The 303(d) list includes stream segments that are water quality limited and indicates parameters that must be improved to meet beneficial water use. The streams in the project area, therefore, are considered by the State to be meeting beneficial water uses, have no water quality limited conditions, and are meeting the State's anti-degradation water policy (SD DENR 2002a; SD DENR 2002b).

3.10.1.6 Groundwater

Groundwater supplies in general range from poor to fair in quality. A few artesian wells that extend into the Dakota Formation provide additional water, but the quality is poor (NRCS 1984). There are no monitoring sites included the Statewide Ground Water Quality Monitoring Network for the aquifers within the project area (SD DENR 2000c).

Table 3.10-2. Beneficial Water Uses in the Project Area

River	Water Body In the Project Area	Beneficial Water Use	Land Units Drained
Little Missouri	Little Missouri (Montana to the North Dakota borders)	<ul style="list-style-type: none"> • Warm water semi-permanent fish life propagation • Limited contact recreation waters 	West Short Pines
Grand	South Fork Grand River (S13, T18N, R3E to Shadehill Reservoir)	<ul style="list-style-type: none"> • Warm water semi-permanent fish life propagation • Limited contact recreation waters 	North half of Slim Buttes
	Big Nasty Creek (S6, T21N, R8E to SF of the Grand River)	<ul style="list-style-type: none"> • Warm water marginal fish life propagation • Limited contact recreation waters 	East-southeast part of North Cave Hills
	Bull Creek (S15, T21N, R5E to SF of the Grand River)		South part of North Cave Hills and South Cave Hills
	Crooked Creek (S34, T23N, R5E to North Dakota Line)		North two-thirds of North Cave Hills
	Jones Creek (S18, T20N, R5E to SF of Grand River)		Southwest-west part of Slim Buttes
Moreau	North Fork Moreau (U.S. Highway 85 to Moreau River)	<ul style="list-style-type: none"> • Warm water marginal fish life propagation • Limited contact recreation waters 	Northeast part of East Short Pines
	Rabbit Creek (S.D. Highway 79 to Moreau)		Eastern part of Slim Buttes
	Antelope Creek (S8, T16N, R9E to Rabbit Creek)		Southeast part of Slim Buttes
	Sand Creek (U.S. Highway 85 to SF Moreau River)		Southeast part of East Short Pines
	Sheep Creek (S30, T16N, R9E to NF Moreau River)		South-southwest part of Slim Buttes

Source: South Dakota DENR 2002a

3.10.1.7 Existing Disturbance by Land Unit

Existing disturbance to water resources are provided in Table 3.10-3. The current level of disturbance is minimal, with the highest road density occurring in South Cave Hills unit at 2.1 miles per square mile. Slim Buttes has the highest number of stream crossings (27), yielding approximately one stream crossing for every six miles of stream, which is quite low. There is less than one acre of road disturbance in riparian areas for all of the land units combined.

Table 3.10-3. Existing Road Effects to Water Resource Features

Land Unit	Roads (mi)	Roads (mi/sqmi)	Stream Crossing (#)	Roads in Riparian (ac)
North Cave Hills	43	1.9	25	0.15
South Cave Hills	29	2.1	10	0.26
Slim Buttes	98	1.3	27	0.17
West Short Pines	4	1.8	3	0
East Short Pines	12	1.3	6	0

3.10.2 ENVIRONMENTAL CONSEQUENCES

3.10.2.1 Effects Common to All Alternatives

Water Quality

All segments of streams with state-designated beneficial water uses are located outside of Forest Service Administrative boundaries; thus, oil and gas leasing activities would not have a direct impact on the designated water bodies. However, oil and gas activities in the headwater tributaries of these streams could have indirect effects on downstream beneficial water use.

These indirect effects include sedimentation from increased soil erosion (Section 3.9) and possible contamination from oil spills and leakage. Construction of drill pads and new access roads have the greatest potential to increase soil erosion with the resulting sediment entering draws and drainage ways. Drill pads can be moved up to 200 meters and away from existing watercourses under the existing BLM Standard Lease Terms (SLTs). Proper planning, construction, and maintenance can substantially reduce watershed erosion from roads. Similarly, road construction and use have the potential to activate areas susceptible to land slides, slumping, and/or mass erosion. Depending on the type of binding materials used, exposure of bare soil could result in varying degrees of continued erosion losses. These effects would be greatest where extensive side hill cuts are constructed. Additional effects from access road construction could include:

- Additional area could become accessible to off-highway vehicles and cause land disturbance.
- Unsurfaced access roads may rut in wet weather or where constructed in wet areas.
- Construction and maintenance activities reduce infiltration rates on road surfaces, disrupt natural drainage by concentrating subsurface and overland flow, and increase channel runoff resulting in gully erosion.

Spills of oil, saline water, and other hazardous materials from production facilities, trucks, and pipelines could affect surface water quality if not adequately contained and cleaned up. As described in section 3.10.1.2, the Forest Plan (USFS 1987, p. 28) directs that oil and gas production facilities and saltwater tanks be constructed to minimize and contain potential spills. In addition, industry standards of equipment, maintenance, and training are expected to be sufficient to minimize the impact on surface water resources by oil and gas field

operations. The Custer National Forest has a Contingency Plan for use and direction in the event of a serious oil or gas spill.

Ground Water

Oil and gas drilling and well development could affect ground water if standard mitigation measures are not applied. Drilling fluids and saline ground water or injection water could affect the quality of aquifers if drilling muds are not used and wells are not properly cased and cemented. Prior to casing and during drilling, drilling muds are typically used to form a “mud cake” on the walls of the well bore to minimize loss of drilling fluids. Hydrostatic head prevents ground water from entering the well bore. Applying standard mitigation measures and following the prescribed minimum standards required in BLM Onshore Order No. 2 for items such as installing and cementing casing through all usable quality water aquifers and into impermeable strata, should adequately protect the ground water resource for all the alternative developments. BLM Onshore Order No. 7 regulates the disposal of produced water. The Custer National Forest Plan directs drillers to use fresh water until well below the Fox Hills formation; and casings must be checked to assure integrity during production, injection and any other uses, for as long as the well exists (USFS 1987, p. 26).

Surface activities from oil and gas fields can also impact the groundwater resource. Leaks from piping and storage tanks, and spills during petroleum transfer operations can reach the water table depending on the depth to water, the volume of petroleum leaked, and the permeability of surface material. Malfunctioning petroleum delivery equipment also can leak petroleum, which may reach the water table if the equipment is not repaired quickly. Industry standards of equipment, maintenance, and training are expected to be sufficient to minimize the impact on groundwater by oil and gas field operations. The Custer National Forest has a Contingency Plan for use and direction in the event of a serious oil or gas spill.

Riparian Habitat and Wetlands

Principal direct effects to riparian areas and wetlands could occur primarily during clearing and earth-moving operations for construction of well pads, access roads, pipelines, and support facilities. Stipulation 12, which is applied to Alternative 2 and Alternative 3, limits oil and gas leasing activities within riparian areas, which by definition include wetlands and floodplains (Section 3.10.1.2).

Indirect, secondary effects may result if site development occurs outside, but adjacent to, riparian areas, woody draws, wetlands, and floodplains where lateral drainage is interrupted by road or well site construction, or when erosion/sediment from construction affects water quality. Roads, well sites, pipelines, and other ancillary facility construction on side slopes above riparian and wetland areas all have the potential to cause sedimentation effects.

Mitigation measures to reduce indirect effects to riparian and wetland areas include: site and routing selection to avoid riparian and wetland areas; checking dams and siltation fences and other Best Management Practices to reduce sedimentation effects; and reclamation of disturbed sites to reduce erosion.

3.10.2.2 Criteria for Measuring Effects

The criteria used to measure effects to hydrologic resources include the indirect measure of land disturbance, which can contribute sediment to watercourses. These measures include area disturbed by roads and well pads, road density, and number of stream crossings by roads. The number of wells in each land unit also indicates the potential for spills and groundwater contamination. In addition, the number of wells could be used as an indicator for potential surface and groundwater contamination, if BMPs and/or regulations were not followed.

The effect to water quality will be qualitatively discussed relative to the potential for increased sedimentation, the capacity to meet State and Federal water quality standards, and impacts to ground water.

3.10.2.3 Alternative 1 - No Action, No New Leases

This Alternative is a projection of the current management situation. No new leases would be granted, and only existing leases held by producing wells would be allowed to continue past expiration of the current lease term.

There are five wells projected by the RFD under the existing leases: two in North Cave Hills and three in South Cave Hills. The disturbance related to this development is presented in Table 3.10-4.

Table 3.10-4. Alternative 1 – Potential Effects on Water Resources

Land Unit	RFD Roads (mi)	Existing Road Density (mi/sqmi)	Road Density With RFD Roads (mi)	RFD Stream Crossing (#)	RFD Disturbance (acres)	
					Short-Term	Long-Term
North Cave Hills	0.28	1.94	1.96	0	11	10
South Cave Hills	0.43	2.11	2.14	0	17	15
Slim Buttes	0.00	1.34	1.34	0	0	0
West Short Pines	0.00	1.82	1.82	0	0	0
East Short Pines	0.00	1.29	1.29	0	0	0

Direct and Indirect Effects

Direct and indirect effects of oil and gas leasing are described in the Section 3.10.2.1, Effects Common to All Alternatives. The effects specific to this alternative include the potential development of two wells in the North Cave Hills unit and three wells in the South Cave Hills unit within existing leases. There would be no additional stream crossings or development within riparian areas. There would be an increase in disturbance of approximately 26 acres short-term and 25 acres long-term for North Cave Hills; and 27 acres short-term and 25 acres long-term for South Cave Hills, respectively. This level of development represents an additional land disturbance of 0.18 percent and 0.25 percent for North Cave Hills and South Cave Hills, respectively. The limited amount of disturbance is unlikely to cause any substantial water quality or hydrologic effects. The five additional wells have potential for affecting groundwater.

Cumulative Effects

Ongoing projects have not changed markedly over the past years. These include existing oil and gas leasing, grazing, reclamation of uranium mines, cleaning out sediment ponds, suppression of wildfires, hunting, and recreation. A fuel break is being planned in Slim Buttes land unit. There will likely be continued oil and gas well development on lands near the project area, although the extent is not known. Since future projects are undergoing environmental analysis, with effects being addressed and controlled by Best Management Practices and Soil Quality Standards, adverse cumulative effects to water resources are not expected.

Summary

The low level increases in short- and long-term disturbance are not expected to have substantial impacts on water resources. There are no new stream crossings, thus, there is no potential for direct impacts on State and federal water quality standards. The Forest's application of Best Management Practices (BMPs), Appendix E, has been effective in reducing indirect effects below that which would affect the beneficial uses of water. Application of the BLM Onshore Order #2 is expected to control these impacts to groundwater. With adherence to Forest Plan standards and guidelines, no substantial adverse effects to riparian areas, wetlands, or floodplains are anticipated from this alternative.

3.10.2.4 Alternative 2 - Lease with Forest Plan Stipulations

This alternative would allow oil and gas leasing with stipulations specified in the amended Forest Plan (USFS 1987, p. 169-174) in addition to the standard BLM SLTs.

Stipulation for Water Resources

Potential adverse effects to water resources from oil and gas leasing would be mitigated through lease stipulations that restrict the location or timing of lease-related activities. The Forest Plan Appendix V (USFS 1987, p. 169-174), as amended, lists oil and gas leasing stipulations for each management area. There is one water resources stipulation that applies:

Stipulation 12: Limited Surface Use (LSU) to minimize surface disturbance in riparian areas. Drill pads will not be located within the riparian ecosystem and will be located to avoid disturbance to the distinctive vegetative communities within the riparian ecosystems unless after analysis the Authorizing Officer determines that locating in alternate sites may be more damaging than occupying this management area. Access and other associated development and production facilities will be routed to cross riparian areas at right angles to minimize road lengths, to maintain stream gradients, and to prevent sedimentation in the streams. (USFS 1987, Appendix V.)

The RFD is an estimate of potential oil and gas leasing activities, and is used to analyze the effects associated with those activities. Since it is only an estimate, it is not sufficient for project-level or site-specific analysis. It represents the level of development that is likely to occur, rather than a specific plan for development. For this alternative, it is assumed that if an RFD well or road occurs on an area included in Stipulation 12, it would be relocated to an area

outside the stipulation zone. Therefore, all of the soil disturbance from the projected RFD would occur within the respective land unit, but potentially at a different location.

Disturbance from RFD roads and wells under Alternative 2 is provided in Table 3.10-5.

Table 3.10-5. Alternative 2 – RFD Roads, Density, Stream Crossings, and Acres of Wells.

Land Unit	RFD Roads (mi)	Existing Road Density (mi/sqmi)	Road Density With RFD Roads (mi/sqmi)	RFD Road Stream Crossing (#)	Total Acres Disturbed	
					Short-Term	Long-Term
North Cave Hills	1.8	1.94	2.03	0	83	75
South Cave Hills	2.6	2.11	2.30	1	67	60
Slim Buttes	0.3	1.34	1.34	0	17	0
West Short Pines	0.1	1.82	1.95	0	11	5
East Short Pines	0.0	1.29	1.29	0	6	0

North Cave Hills

This unit has the most projected development out of all of the land units, with a total of 83 acres of short-term and 75 acres of long-term disturbance from RFD wells and roads. The total potential land disturbance would be approximately 0.5 percent of the land unit. There would be a projected road density increase of approximately 0.1 mile/square mile and no new stream crossing by RFD roads compared to Alternative 1. The 12 additional projected wells have potential for affecting groundwater.

South Cave Hills

This unit has a total of 67 acres of short-term and 60 acres of long-term disturbance from the projected activities, bringing the total disturbance to 0.7 percent of the land unit. There would be a projected road density increase of approximately 0.2 mile/square mile and one additional stream crossing (SCH9) by RFD roads compared to Alternative 1. The 10 additional projected wells have potential for affecting groundwater.

Slim Buttes

This unit has a total of 17 acres of short-term and zero acres of long-term disturbance from the projected activities, because the RFD wells are projected to be dry holes. There would be no substantial increase in road density and no new stream crossings by RFD roads. This unit does not have existing oil and gas leases. The three projected new wells have a short-term potential for affecting groundwater.

West Short Pines

This unit has a total of 11 acres of short-term and 5 acres of long-term disturbance from the projected activities, bringing the total to 0.4 percent of the land unit affected. There would be an increase in road density of approximately 0.13 mile/square mile and no new stream crossings by RFD roads. This unit does not have existing oil and gas leases. The two projected new wells

have potential for affecting groundwater; however, one RFD well is projected to be a dry hole, so one groundwater impact would be short-term.

East Short Pines

This unit has a total of six acres of short-term and zero acres of long-term disturbance from the projected activities. The one RFD well is projected to be a dry hole so no long-term disturbance is anticipated. There would be no substantial increase in road density and no new stream crossings by RFD roads. This unit does not have existing oil and gas leases. The one projected new well has a short-term potential for affecting groundwater.

Cumulative Effects

Ongoing projects have not changed markedly over the past years. These include existing oil and gas leasing, grazing, reclamation of uranium mines, cleaning out sediment ponds, suppression of wildfires, hunting, and recreation. A fuel break is being planned in Slim Buttes land unit. There will likely be continued oil and gas well development on lands near the project area, although the extent is not known. Since future projects are undergoing environmental analysis, with impacts being addressed and controlled by Best Management Practices, Appendix E, and Soil Quality Standards, adverse cumulative effects to water resources are not expected.

Summary of Effects

The small increases in short- and long-term disturbance are not likely to have substantial impacts on water resources. The one additional stream crossing is on an intermittent, ephemeral stream, so there would be no direct impacts to State and federal water quality standards. Indirect impacts of sedimentation from RFD sites are not expected because the impacts will be controlled by using Best Management Practices. Application of the BLM Onshore Order #2 is expected to control these impacts to groundwater. The CSU stipulation for riparian areas would reduce direct effects to this resource. In addition, well sites and other facilities could be moved up to 200 meters without the need for additional lease stipulations. This adjustment opportunity would allow for the avoidance of key resources (i.e., riparian and wetland areas) in the event that such sites are identified after lease areas have been designated. The discretionary authority to relocate any projected activity by 200 meters effectively provides for a 400-meter-wide corridor centered on riparian strips and streams.

Irreversible/Irretrievable Effects

There are no foreseeable irreversible or irretrievable effects on water resources.

3.10.2.5 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

Disturbance from Alternative 3 is shown in Table 3.10-6. There are nine less wells projected for this alternative compared to Alternative 2, therefore there would be 40 less acres of long-term disturbance. There would be a small decrease in road density and no change in stream crossing by RFD development, compared to Alternative 2.

Table 3.10-6. Alternative 3 – RFD Roads, Density, Stream Crossings, and Acres of Wells.

Land Unit	RFD Roads (mi)	Existing Road Density (mi/sqmi)	Road Density With RFD Roads (mi/sqmi)	RFD Road Stream Crossing (#)	Total Acres Disturbed	
					Short-Term	Long-Term
North Cave Hills	0.49	1.94	1.97	0	44	40
South Cave Hills	3.35	2.11	2.35	1	61	55
Slim Buttes	0.24	1.34	1.34	0	11	0
West Short Pines	0.27	1.82	1.95	0	11	5
East Short Pines	0.0	1.29	1.29	0	6	0

North Cave Hills

North Cave Hills is entirely NSO in this alternative. Given the projections, there would be a total of 44 acres of short-term and 40 acres of long-term disturbance from RFD projected off-Forest wells and roads. No new stream crossings would occur on-Forest. There are seven less RFD wells compared to Alternative 2. The remaining five RFD wells have a potential for affecting groundwater.

South Cave Hills

This unit has a total of 61 acres of short-term and 55 acres of long-term disturbance from the projected activities, which is 0.6 percent of the land unit. There is one less RFD well but the road density is slightly greater compared to Alternative 2. There is no change in stream crossings compared to Alternative 2. The nine RFD wells have potential for affecting groundwater.

Slim Buttes

Slim Buttes is entirely NSO in this alternative. Given the projections, there would be a total of 11 acres of short-term and zero acres of long-term off-Forest disturbance from the projected activities, because the two new off-Forest wells are projected to be dry holes. There would be no substantial increase in road density and no new stream crossings by RFD roads. The two off-Forest dry hole RFD wells have a potential for short-term effects on groundwater.

West Short Pines

This unit has a total of 11 acres of short-term and 5 acres of long-term disturbance from the projected activities, which is 0.4 percent of the land unit. There would be an increase in road density of approximately 0.13 mile/square mile and no new stream crossings by RFD roads. This unit does not have existing oil and gas leases. Although the two RFD wells have a potential for affecting groundwater, one of the wells is projected to be a dry hole, resulting in a short-term effect.

East Short Pines

This unit has a total of six acres of short-term and zero acres of long-term disturbance from the projected activities, because the one RFD well is projected to be a dry hole. There would be no

substantial increase in road density and no new stream crossings by RFD roads. This unit does not have existing oil and gas leases. The one dry hole RFD well has a potential for short-term effects on groundwater.

Cumulative Effects

Ongoing projects have not changed markedly over the past years. These include existing oil and gas leasing, grazing, reclamation of uranium mines, cleaning out sediment ponds, suppression of wildfires, hunting, and recreation. A fuel break is being planned in Slim Buttes land unit. There will likely be continued oil and gas well development on lands near the project area, although the extent is not known. Since future projects are undergoing environmental analysis, with impacts being addressed and controlled by Best Management Practices, Appendix E, and Soil Quality Standards, adverse cumulative effects to water resources are not expected.

Summary of Effects

The small increases in short- and long-term disturbance are not likely to have substantial impacts on water resources. The two additional stream crossings are on intermittent, ephemeral streams, so no direct impacts to State and federal water quality standards are expected. Indirect impacts of sedimentation from RFD sites are expected to be controlled by use of Best Management Practices. Application of the BLM Onshore Order #2 is expected to control these impacts to groundwater. The CSU stipulation for riparian areas would reduce direct effects to this resource. In addition, well sites and other facilities could be moved up to 200 meters under SLTs without the need for additional lease stipulations. This adjustment opportunity would allow for the avoidance of key resources (i.e., riparian and wetland areas) in the event that such sites are identified after lease areas have been designated. The discretionary authority to relocate any projected activity by 200 meters effectively provides for a 400-meter-wide corridor centered on riparian strips and streams.

Irreversible/Irretrievable Effects

There are no foreseeable irreversible or irretrievable effects on water resources.

3.11 ISSUE 10: NOXIOUS WEEDS

Under the Noxious Weed Act of 1974, US Department of Agriculture Policy 9500-10, and US Forest Service Policy (Forest Service Manual 2080), the Forest Service is responsible for developing and utilizing an integrated pest management approach to manage noxious weeds on National Forest System lands. Specifically, the Forest Service has the responsibility to prevent, control, and eradicate noxious weeds on National Forest System lands. Prevention is the most cost-effective means for reducing the spread of noxious weeds.

There is concern that vehicles and equipment, as well as the construction of drilling pads and roads for oil and gas exploration, development, and production, may provide suitable transport and habitat, respectively, for noxious weeds to infest new and larger areas.

3.11.1 AFFECTED ENVIRONMENT

Noxious weed infestations on the Custer National Forest involve approximately 1,800 acres (personal communication, Kim Reid, Range Scientist, Custer National Forest, October 2002). Spotted knapweed is by far the predominant species (approximately 1,500 acres). Other species of concern are Canada thistle, hounds tongue, dalmation and common toadflax, and leafy spurge.

Present control methods have been predominantly chemical. In spite of the acreage treated each year, the number of acres infested has tended to increase. Current management is designed to decrease the rate of spread until more effective control methods are found and developed.

3.11.1.1 Noxious Weed Species of Concern in the Project Area

Spotted knapweed (*Centaurea maculosa*)

Spotted knapweed is a short-lived perennial, reproducing solely by seeds that germinate from spring through early fall. The plant grows two to four feet tall and produces numerous flowers from early July through August. Spotted knapweed spreads readily on vehicle undercarriages

Canada thistle (*Cirsium arvense*)

Canada thistle is an aggressive, creeping perennial weed that infests crops, pastures, rangeland, roadsides, and noncrop areas. Generally, infestations start on disturbed ground, including ditch banks, overgrazed pastures, tilled fields, or open waste places. Canada thistle reduces forage consumption in pastures and rangeland because cattle typically will not graze near infestations.

Canada thistle develops seed sparingly. Seed may be transported long distances by water, or attached to animals, clothing, farm equipment, and other vehicles. Seed can remain viable in soil up to 20 years, and deep burial promotes survival longevity.

Leafy spurge (*Euphorbia esula*)

Leafy spurge is a member of the spurge family characterized by plants containing a white milky sap and flower parts in threes. Leafy spurge is an erect, branching, rhizomatous, perennial herb two to three-and-a-half-feet tall, with smooth stems and showy yellow flower bracts. Clusters of

these showy, yellow bracts open in late May or early June, while the actual flowers do not develop until mid-June.

Leafy spurge is an aggressive invader and can completely overtake large areas of open land. It displaces native vegetation in prairie habitats and fields through shading, by usurping available water and nutrients, and through production of plant toxins that prevent the growth of other plants underneath it.

3.11.2 ENVIRONMENTAL CONSEQUENCES

Healthy stands of natural vegetation are generally able to suppress weed development. However, if the soil and natural vegetation are disturbed in some way, weeds are able to take advantage of the decrease in competition for resources. Additionally, the lack of natural predators enhances the aggressive growth characteristics of noxious weeds. For weeds to invade new habitats, the seeds must be dispersed to these areas. Weeds are primarily spread through soil disturbance and seed transport.

When a vehicle is driven through a weed-infested area, weed seeds may become lodged between the tire treads, in the coils of a winch, behind the license plate, or in cracks and crevices on the underside of the vehicle. The source of many infestations has been traced to roads, trails, railroads, and other travel ways. Seeds may travel hundreds of miles before dropping off into areas that had no weed infestation.

The goal of noxious weed management is to implement an integrated management program aimed at controlling new starts, priority areas, and areas of minor infestations. Holding actions will be implemented on areas of existing large infestations. Preferred control methods will be biological when such methods are available and feasible. Until that time, approved herbicides and mechanical methods will be used. In some cases, biological and chemical control methods may be necessary to adequately control noxious weeds.

3.11.2.1 Alternative 1 – No Action, No New Leases

The existing lease terms have no noxious weed prevention or control terms. It is assumed that noxious weed control would be considered where substantial infestations occur on lease sites; however, the responsibility would likely fall on the government. As a preventative measure, Forest Service personnel can request that lessees clean the surface and undercarriage of vehicles before entering portions of a lease where the surface is being disturbed.

3.11.2.2 Alternative 2 – Lease with Forest Plan Stipulations

The Custer National Forest Plan has no specific lease stipulations for noxious weed prevention and control for oil and gas exploration and development activities (USFS 1987). However, the FS/BLM could issue a Lease Notice (LN) to the lessee under the general authority of the BLM standard lease terms Section 6 requiring that:

- Lessees will follow Forest Service Best Management Practices for noxious weed detection, prevention, and treatment per policy (FSM 2080, Supplement R1 2000-2001-1).

- Lessees will train all employees with respect to noxious weed identification.
- Lessees will make arrangements for weed control upon positive identification of noxious weeds.
- Lessees will require employees and contractors to clean equipment and vehicles, especially vehicle undercarriages, before bringing them onto National Forest System lands and into the project vicinity so as to prevent introduction and spread of noxious weeds.
- Include weed prevention measures in operation and/or reclamation plans.
- Should noxious weeds be introduced in areas disturbed by the lessee, the lessee will be responsible for developing a noxious weed eradication plan for FS approval. The lessee will be responsible for implementing the plan. Only those chemicals that are labeled under state and federal laws for target species, and which experience and research have proven effective for weed control, will be used. Chemical treatment will be avoided in areas where such treatment will have a substantial impact on water resources, key wildlife habitat, or unique vegetation. Isolated new noxious weed starts will be controlled to prevent further expansion into other areas. Where chemicals are used, techniques will be utilized to reduce the amount applied per acre. All pesticide applicators on National Forest System lands will be commercially certified under the applicable federal or state law. The use of chemicals will be in agreement with NEPA requirements.
- Biological control techniques that become available and are proven safe and effective will be favored over chemical methods. Research efforts by universities and research stations will be encouraged and new feasible technology resulting from this research will be applied.

The Lease Notice (LN) would be enforceable unless the requirements were considered to infringe upon the rights of the lessee to develop the sub-surface resource.

3.11.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

Under Alternative 3, the Alternative 2 LN would be changed to a Controlled Surface Use (CSU) lease stipulation and, as such, would be more enforceable.

3.12 ISSUE 11: AIR QUALITY

3.12.1 AFFECTED ENVIRONMENT

The Sioux Ranger District oil and gas lease area lies solely within the boundaries of Harding County, South Dakota, which is in the northwestern corner of the state. The air quality effects of oil and gas leasing can be influenced by a number of factors, including but not limited to:

- Topography
- Climate and Weather Patterns
- Population Density and Related Activities
- Industrial and Commercial Sources of Air Contaminants
- Pollutant Transport

3.12.1.1 Topography

South Dakota is characterized topographically as a region of rolling plains that vary from nearly level land to hilly ridges. Elevations generally increase from the eastern state border (1,500 feet above mean sea level [amsl]) moving west and northwest (3,000 feet amsl). Elevations in Harding County typically range from 2,500 to 3,200 feet amsl.

3.12.1.2 Climate and Weather Patterns

South Dakota is situated in the heart of the North American Continent, and as such, experiences extremes of summer heat and winter cold that are characteristic of continental climates. Rapid fluctuations in temperature are common. The region lies approximately 1,000 miles from the Pacific Ocean, and as such, there is little moderation to daily, monthly, and annual temperatures. Temperatures as high as 100°F or higher are common in some parts of the state each summer. These high temperatures are accompanied by conditions of low humidity. Below-zero temperatures occur frequently during the winter months, primarily during the morning hours, but it is rare for the temperature to stay below zero over the course of an entire day.

Due to the tendency for cold air masses to stay at low elevations, some of the arctic air outbreaks that blanket the eastern counties do not reach the higher elevation counties in the western portion of the state (including Harding County).

Annual precipitation decreases northwestward from approximately 25 inches per year in the extreme southeast to less than 13 to 15 inches per year in the northwest portion of the state (Harding County). Most of the state's and the lease region's precipitation occurs from April through October. Rainstorms occur most frequently in early summer, with hailstorms most frequent in midsummer. The least precipitation is received in the winter period. Occasionally there can be heavy snowfall episodes in winter and the amount of snow on the ground can accumulate to considerable depth. Most snowfall events are accompanied by moderate to high winds that cause the snow to collect in low-lying areas, gullies, and behind windbreaks.

South Dakota and Harding County have considerable periods of fair weather. Since much of the weather arrives by way of the Rocky Mountains and Canada, the air in the region is generally

clear and visibility is excellent. Winds are generally from the south to southeast during the summer and from the north and northwest during the winter. Wind speeds are moderate during the daylight hours and calm at night. Wind speeds average 11 to 12 mph on an annual basis. Wind data from Rapid City Airport, which lies approximately 80 miles south of the lease area, confirms the predominant wind directions as south to southeast and northwest to north. Wind rose data for the airport for the years 1986 through 1990 are included in the project record.

Historical and current weather and climate data is gathered at four surface weather stations within Harding County, as follows:

- Camp Crook, elevation 3,123 ft., Lat 45 deg 32 min N, Long 103 deg 59 min W
- Ludlow, elevation 2,851 ft., lat 45 deg 52 min N, Long 103 deg 25 min W
- Ralph 1 N, elevation 2,831 ft., Lat 45 deg 48 min N, Long 103 deg 6 min W
- Redig 11 NE, elevation 2,992 ft., Lat 45 deg 22 min N, Long 103 deg 24 min W

The following Table 3.12-1 presents a general summary of annual data from these stations.

Table 3.12-1. Annual Data Summary from Harding County Weather Stations

Weather Station	Max Temp (°F)	Min Temp (°F)	Average Temp (°F)	Total Rainfall (In.)	Total Snowfall (In.)
Camp Crook	58.6	30.1	44.3	13.94	32.3
Ludlow	56.5	31.0	43.8	16.33	N/A
Ralph 1 N	57.5	29.1	43.4	15.69	N/A
Redig 11 NE	56.8	30.7	43.8	15.22	49.5

3.12.1.3 Population Density and Related Activities

Harding County covers an area of 2,671 square miles and has a population of 1,353 (US Census Bureau 2000). Population density is approximately 0.5 persons per square mile. Harding County has no identified metropolitan areas. The major employment base is agricultural (farm-related). Non-farm employment comprises approximately 13 percent of the population, while government employment comprises approximately 6 percent of the population.

3.12.1.4 Industrial and Commercial Sources of Air Contaminants

Presently, the State of South Dakota DENR (Air Division) does not tabulate emissions for inventory purposes on a county level. Data acquired from the state showing the state air emissions inventory is presented in Table 3.12-2.

Table 3.12-2. State Air Emissions Inventory for Calendar Year 2001

Pollutant	Emissions (tons/year)
Oxides of Nitrogen	22,503
Carbon Monoxide	2,971
Particulate Matter (PM ₁₀)	1,167
Oxides of Sulfur	15,728
Volatile Organic Compounds	3,388

Source: Brad Shultz, Senior Scientist, South Dakota DENR-Air, July 2002.

Data supplied by the South Dakota DENR and tabulated by Foster Wheeler staff for sources in Harding County shows the following:

Table 3.12-3. Source/Emissions Data for Harding County

Pollutant	Emissions (tons/year)
Oxides of Nitrogen	Nd
Carbon Monoxide	Nd
Particulate Matter (PM ₁₀)	Nd
Oxides of Sulfur	Nd
Volatile Organic Compounds	< 1
Total Sources Listed	1

Source: Brad Shultz, Senior Scientist, South Dakota DENR-Air, July 2002.

Pollutant Transport

Transport of pollutants from other regions, in some instances, can contribute substantially to the ambient air quality of the receiving region. Transport effects on the air quality of Harding County are presently insubstantial due to the following:

- Lack of any substantial metropolitan or industrial areas within the predominant wind patterns that could contribute to the area's pollutant load.

Current Air Quality Status of Harding County

Data supplied by the South Dakota DENR (Air Division) staff indicates that the air quality of Harding County is excellent (personal communication, Brad Shultz, Senior Scientist, South Dakota DENR-Air, July 2002). The County is currently in compliance with all National Ambient Air Quality Standards (NAAQS) as delineated in Table 3.12-4.

Presently, no ambient air monitoring is being conducted in Harding County, and DENR has no plans to initiate monitoring in the area. Table 3.12-5 presents the NAAQS status for the County.

Table 3.12-4. Ambient Air Quality Standards

Pollutant	Averaging Time	South Dakota Standards ^a	National Standards ^b	
			Primary ^c	Secondary ^d
Ozone	8 Hour	Same as NAAQS	0.08 ppm	0.08 ppm
	1 Hour		0.12 ppm	0.12 ppm
Carbon Monoxide	8 Hour	Same as NAAQS	9 ppm	--
	1 Hour		35 ppm	--
Nitrogen Dioxide	Annual Average	Same as NAAQS	0.053 ppm	0.053 ppm
	1 Hour		--	--
Sulfur Dioxide	Annual Average	Same as NAAQS	80 µg/m ³	--
	24 Hour		365 µg/m ³	--
	3 Hour		--	1,300 µg/m ³
	1 Hour		--	--
PM ₁₀	Annual Geometric Mean	Same as NAAQS	--	--
	Annual Arithmetic Mean		50 µg/m ³	50 µg/m ³
	24 Hour		150 µg/m ³	150 µg/m ³
PM _{2.5}	Annual Arithmetic Mean	Same as NAAQS	15 µg/m ³	15 µg/m ³
	24 Hour		65 µg/m ³	65 µg/m ³
Sulfates	24 Hour	--	--	--
Lead	30 Day Average	Same as NAAQS	--	--
	Calendar Quarter		1.5 µg/m ³	1.5 µg/m ³
Hydrogen Sulfide	1 Hour	--	--	--
Vinyl Chloride	24 Hour	--	--	--
Visibility Reducing Particles	8 Hour (10 a.m. to 6 p.m., PST)	--	--	--
Hydrocarbons or reactive organic compounds (ROC)	-----	-----	-----	See Note ^e

^aSouth Dakota ambient air quality standards are the same as the Federal NAAQS.

^bNational standards, other than ozone and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

^cNational Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

^dNational Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

^eThe federal ambient standard for hydrocarbons was revoked by the Environmental Protection Agency in 1983.

ppm = parts per million (by volume).

Table 3.12-5. Harding County Attainment Status

Pollutant	Air Quality Status
NO ₂	Attainment
Carbon Monoxide	Attainment
Particulate Matter (PM ₁₀)	Attainment
SO ₂	Attainment
Ozone	Attainment

Source: Brad Shultz, Senior Scientist, South Dakota DENR-Air, July 2002.

The following is a brief discussion of the characteristics and effects of the primary criteria pollutants and their precursors as listed in Table 3.12-5 above.

Ozone

Sources—Ozone, the major constituent of smog, is formed through a complex series of chemical reactions and transformations in the presence of sunlight. Reactive and volatile organic compounds (ROC and VOC) and oxides of nitrogen (NO_x) are the principal constituents in these reactions. Ozone is formed by complex photochemical reactions in the atmosphere involving NO_x and ROC/VOC with ultraviolet energy from sunlight. Motor vehicles, power plants, the petroleum industry, pesticides, and organic solvents are the major sources of NO_x and ROC/VOC. Ozone is a pungent, colorless, toxic gas created when three oxygen molecules bond together. Ozone is known as a secondary pollutant since the gas is formed in the atmosphere, rather than emitted directly into the air. The period of highest ozone levels and greatest frequency of occurrence typically extends from May through October and is known as “smog season.”

Effects—Ozone is a strong irritant, which attacks the respiratory system, leading to lung tissue damage. Asthma, bronchitis, and other respiratory ailments, as well as cardiovascular disease, are aggravated by exposure to ozone. Healthy people exposed to high ozone concentrations may become nauseated or dizzy, may develop headaches or coughs, or may experience a burning sensation in the chest. Symptoms appear to be aggravated by exercise. Ozone adversely affects vegetation, including damage to food crops, ornamental plants, and natural vegetation including forests. Ozone also affects materials such as surface coatings, fabrics, and rubber.

Additionally, it should be noted that the region, like other similar rural areas is most likely a “NO_x Limited” ozone region. NO_x limited ozone regions are those in which the concentration of ozone depends on the amount of NO_x in the atmosphere. Typically, these areas have high VOC concentrations and low NO_x concentrations. In these regions, the primary strategy to reducing ozone would be the reduction of NO_x emission, with the secondary strategy of reducing VOC emissions.

Oxides of Nitrogen

There are a number of NO_x compounds, but only two are important in air pollution: nitric oxide (NO), a colorless, odorless gas formed from atmospheric nitrogen and oxygen when combustion

takes place under high temperature and/or pressure; and nitrogen dioxide (NO₂), a reddish-brown irritating gas formed by the combination of nitric oxide with oxygen. Nitrogen oxide plays a critical role in the photochemical reaction that produces ozone.

Sources—High temperature combustion causes nitrogen and oxygen to combine and form NO and NO₂. Further reaction produces additional NO_x. Combustion in motor vehicle engines, power plants, refineries, and other industrial operations all generate NO_x emissions.

Effects—Exposure to NO₂ increases the incidence of respiratory infections among children, and causes difficulty in breathing among healthy people, persons with chronic bronchitis, and in asthmatics. An increased incidence of acute respiratory disease in children and adults may occur after repeated exposure to elevated levels of NO₂ in combination with other pollutants. NO₂ also causes visibility problems. The gas creates the brownish haze often associated with smog.

Sulfur Dioxide

Sulfur dioxide (SO₂) is a colorless, pungent, irritating gas formed primarily by the combustion of sulfur-containing fossil fuels. In humid conditions, some of the SO₂ may be changed to sulfur trioxide and sulfuric acid mist, with some of the latter eventually reacting with other materials to produce sulfate particulates.

Sources—This contaminant is a by-product of combustion of sulfur-containing fossil fuels. Fuel combustion is a major source of SO₂. Power plants and motor vehicles account for the majority of the SO₂ emissions.

Effects—At high concentrations, SO₂ irritates the upper respiratory tract. At lower concentrations in conjunction with particulate matter, SO₂ harms the lung tissues. SO₂ also has adverse effects on plant growth. Finally, SO₂ can form sulfate aerosols in the atmosphere, which reduce visibility.

Hydrocarbons

Any of the vast family of compounds consisting of hydrogen and carbon in various combinations are known as hydrocarbons. Fossil fuels are included in this group. Many hydrocarbon compounds are highly photochemically reactive and play an important role in ozone formation and visibility impairment.

Sources—Motor vehicles, organic solvents, petroleum recovery operations, pesticides and herbicides, and organic solvents are all major sources of hydrocarbons. These hydrocarbons are often referred to as reactive organic compounds (ROC). The federal ambient standard for hydrocarbons was revoked by the Environmental Protection Agency in 1983.

Effects—Levels of hydrocarbons currently measured in urban areas are not known to cause adverse effects on humans. However, certain members of the hydrocarbon group are important components (precursors) in the reactions, which produce photochemical smog (ozone).

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, toxic gas produced by incomplete combustion of carbon-containing substances. CO concentrations are generally higher in the winter months during morning hours, when vertical mixing of the atmosphere is limited.

Sources—Motor vehicles are the primary source of CO. Combustion processes from various industrial sources also produce substantial amounts of CO.

Effects—Carbon monoxide does not irritate the respiratory tract, but passes through the lungs directly into the blood stream and, by interfering with the transfer of fresh oxygen to the blood, deprives sensitive tissues of oxygen. CO is not known to have adverse effects on vegetation, visibility, or materials.

Particulate Matter (PM₁₀ and PM_{2.5})

Atmospheric particulates are made up of fine solids or liquids such as soot, dust, aerosols, fumes, and mists. A large portion of the particulate suspended in the atmosphere is finer than 10 microns (one micron is one millionth of a meter). These small particulates cause the greatest health risk, and have both federal and state standards.

Sources—Particulate matter consists of particles in the atmosphere resulting from many kinds of fume-producing industrial and agricultural operations, motor vehicle tires, combustion, and atmospheric photochemical reactions. Natural activities also release particulates into the atmosphere; wind-blown dust is most likely the predominant form of particulates from natural sources in the study area.

Effects—The nose and throat are able to stop most large particles. However, very small particles can easily bypass this natural filtering system and lodge deep in the lungs. PM₁₀ and PM_{2.5} are considered a greater health risk than larger particles due to their ability to be inhaled deep into the lungs. PM₁₀ and PM_{2.5} particles cannot be removed from the lungs by exhaling, and may be carriers of toxic materials that can be absorbed by the blood and carried to other parts of the body. Suspended in the air, particulates can both scatter and absorb sunlight, producing haze and reducing visibility.

3.12.1.5 Visibility

Visibility in Harding County and the western one-third of South Dakota is excellent. Regional background visual range values for the area are on average equal to or greater than 110 km (68 miles). Emissions of the above delineated criteria pollutants may individually and cumulatively affect the region's overall visibility.

3.12.1.6 Existing Oil and Gas Activities

Data derived from the recently published report entitled "*Reasonably Foreseeable Development Scenario for Oil and Gas in the Cave Hills, Slim Buttes, and Short Pines Areas, BLM, USDA Forest Service-Region 1, May 17, 2002,*" shows the following with respect to existing oil and gas activities in Harding County:

- All of Harding County is classified as having high potential for the occurrence of oil and gas. The high potential ranking is based on the demonstrated presence of oil and gas in pooled accumulations, located at the Buffalo, Yellow Hair, and West Short Pines fields.
- Approximately 300 wells have been drilled in the South Dakota portion of the Williston Basin, a portion of which lies within Harding County.
- Oil and gas leasing decisions made by the Forest Service (FS) and Bureau of Land Management (BLM) currently affect only a small portion of Harding County. No leases have been issued since the late 1980's.
- Leasing forecast data indicates a potential for federal oil and gas mineral leases for 77,805 acres. As of October 2001, there were 4,590 leased federal acres held by production (HBP).
- Based on technology advances and historical drilling rates, 50 to 100 new oil and gas wells are forecasted for development/drilling in Harding County over the time frame of the planning period, i.e., 15-year analysis period.

3.12.1.7 Applicable Air Quality Rules and Regulations

The EPA and the State of South Dakota have established air quality rules and regulations that would apply to projected oil and gas development projects, independent of NEPA. Following is a summary of the rules and regulations that would potentially have the greatest effect on these types of projects. These rules will need to be addressed at the project level, at such time that an applicant proposes specific development of a prospect or lease area.

General Conformity Rule

The Clean Air Act Amendment of 1990 required the EPA to promulgate rules to ensure that federal actions conform to appropriate State Implementation Plans (SIPs). The EPA published General Conformity regulations in the Federal Register (40 CFR Part 6, 51, and 93) dated November 30, 1993. The conformity provisions of the Clean Air Act, Section 176(c), prohibit federal agencies from taking any action that causes or contributes to any new violation of the NAAQS, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard. Conformity to a SIP is defined in the Act as meaning conformity to a SIPs purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

The general conformity rule applies to criteria pollutants in nonattainment or maintenance areas. Maintenance areas are former nonattainment areas that have been brought back into compliance with the NAAQS. In general, a project conforms to the SIP if the total of its direct and indirect emissions are either included in the SIPs emission inventory or are less than the *de minimus* emission thresholds. If project emissions exceed the *de minimus* emission thresholds, conformity can also be demonstrated through dispersion modeling if the modeling results predict no new or exacerbated air quality violations. A project that does not conform can only proceed if it is mitigated to the point at which it conforms. The mitigation could include changes to the project scope or emission offsets.

Since this study addresses generic oil and gas development activities only and is not project-specific, it is not possible at this time to know precisely when, and to what extent, each prospect area would be developed. Furthermore, although it is not possible to know the specific number and types of emission-generating equipment that would be used at each prospect area, data derived from other oil and gas leasing EISs indicates that such development emissions are minor and result in insubstantial effects to regional air quality. Since the specific or actual project-level emissions cannot be predicted at this time, a conformity determination is not possible. A conformity determination will be required when an applicant proposes to conduct operations on a particular lease.

Prevention of Significant Deterioration

As part of the Clean Air Act, the EPA established a program called Prevention of Significant Deterioration (PSD), which seeks to protect attainment areas from further degradation. A stationary source would trigger PSD review if its direct emissions of an attainment pollutant exceed established emission thresholds. Once PSD is triggered, the following would be required:

- Application of Best Available Control Technology (BACT)
- Pre- and post-construction ambient monitoring may be required
- Air quality impact analysis
- Visibility, soils, and vegetation impact analysis
- Assess impact on air quality related values (AQRVs) in federal Class I areas (discussed in the following section)

In the air quality impact analysis, an applicant must demonstrate that the NAAQS are not violated and that ambient air quality levels do not degrade beyond allowable increments. Dispersion modeling of project emissions is typically the method used in such a demonstration.

The EPA has delegated the authority to administer the PSD program to the South Dakota DENR (Air Division) pursuant to Air Pollution Control Program regulation 74:36:09. The PSD discussion is provided here to help explain Forest Service responsibility for Class I wilderness areas.

USDA Forest Service Air Quality Review Criteria

The Clean Air Act (CAA) of 1977 gives Federal Land Managers (FLMs), including the Forest Service, an affirmative responsibility to protect the air quality related values (AQRVs) within Class I wilderness areas. The CAA is a tool that can be implemented to meet the management goals and objectives of the Wilderness Act and the National Forest Management Act.

Authority to protect AQRVs in Class I areas is given to FLMs through the federal PSD program. A permit applicant is required to demonstrate that the proposed facility will not cause or contribute to adverse effects to AQRVs in any Class I area. The FLMs have established thresholds for acceptable air pollution-caused changes at sensitive receptors. They must determine whether the projected facility would cause adverse effects to those receptors. Examples of AQRVs, sensitive receptors, and factors potentially changed by air pollution are listed in Table 3.12-6.

Table 3.12-6. Examples of AQRVs, Sensitive Receptors, and Factors Potentially Changed by Air Pollution

AQRV	Sensitive Receptors	Factors Changed by Air Pollution
Flora	Ponderosa pine, lichens	Growth, mortality, reproduction, visible injury
Water	Alpine lakes	Total alkalinity, pH, metal concentration, dissolved oxygen
Soil	Alpine soils	pH, cation exchange capacity, base saturation
Visibility	High usage vista	Contrast, visual range, coloration
Cultural/archaeological values	Pictographs	Decomposition rate
Odor	Popular hiking trail	Odorous emissions (H ₂ S, SO ₂ , ozone)

Class I areas are those wilderness areas greater than 5,000 acres that were in existence as of August 7, 1977, or any later expansions made to these wildernesses. All other National Forest lands are Class II, including new wilderness. The closest Class I areas to the Sioux Ranger District are as follows:

- Wind Cave National Park
- Badlands National Park

At the time of project-level review, if the project emissions trigger PSD review, the applicant will need to demonstrate that the project would not have a substantial adverse effect on AQRVs in these Class I areas. Visibility and dispersion modeling are typically used in these demonstrations.

New Source Review Rule

The State of South Dakota DENR has been delegated authority over stationary emission sources. The State must develop rules that are at least as stringent as federal rules. The new source review (NSR) rule is the mechanism by which the State formally reviews and issues operating permits for new and modified sources of air emissions. Through the NSR process, the State has the authority to require:

- Conditions that limit a source's operations
- Installation of Best Available Control Technology (BACT)
- Acquisition of emission offsets to negate an emission increase
- Demonstration of compliance with the ambient air quality standards via an air quality impact analysis
- Regular emission testing

The requirements of the NSR rules vary from agency to agency, depending on a number of factors, including the air quality status of the region in question.

Any stationary emission sources proposed by an applicant as part of a drilling or production facility would be subject to the State of South Dakota DENR minor source, or PSD, and NSR

rules. Such equipment includes drilling rigs, oil or gas well pumps, temporary flares, production tanks, and fugitive VOC and PM emissions.

State Air Quality Rules

In addition to the minor source, PSD, and NSR rules, South Dakota has established a series of prohibitory rules, some of which would apply to oil and gas leasing and development projects. Some of these current rules are noted here in Table 3.12-7.

Table 3.12-7. State-Adopted Regulations and Prohibitory Rules per APCP Article 74:36

APCP Section	Rule Description
74:36:01:01	Definitions
74:36:01:08	Major Source
74:36:10:12	Potential To Emit
74:36:01:17	Significant Emissions Increase
74:36:04:01-30	Minor Source Permits
74:36:06:02	Allowable Emissions-Fuel Burning Sources
74:36:06:03	Process Weight Rule
74:36:07	New Source Performance Standards
74:36:11	Performance Testing
74:36:12	Control of Visible Emissions

In addition to the above, discussions with South Dakota DENR-Air staff revealed the following pertaining to oil and gas development projects (personal communication with Brad Shultz, Senior Scientist, South Dakota DENR-Air, July 18, 2002):

- Oil and gas drilling rigs are considered to be mobile equipment, and air permits are not required.
- Drilling rigs and other emitting equipment that are located at a site for less than six months may be considered “temporary sources.”

Notwithstanding the above, State staff requests that lease holders notify them of drilling and other activities prior to commencement in order to evaluate the need for minor source permits or operational conditions.

3.12.1.8 Forest Plan Goals and Objectives

The Custer National Forest Land and Resources Management Plan contains an air quality element with air quality goals and objectives, as follows:

- *Goals - The goal of air resource management is to meet or exceed state air quality standards and ensure protection of air quality related values.*
- *Objective - Air quality of the National Forest System lands will be maintained at or above levels required by Federal and State laws, regulations, and standards. The*

Forest Service will work with state and other Federal agencies to assure these standards are met.

- *Process to Reach Goals and Objectives -*

- 1) *Air Quality will be protected by cooperating with Montana, North Dakota, and South Dakota Air Quality Bureaus in the Prevention of Significant Deterioration (PSD) program and State Implementation Plans (SIP). Requirements of the PSD, SIP, and State of Montana, North Dakota, and South Dakota Smoke Management Plans will be met whenever the FS has authority to do what is required. The Forest will cooperate with states, other agencies, and organizations in identifying, evaluating, proposing solutions, and monitoring air quality problems associated with activities permitted on National Forest and National Grassland surface.*

- 2) *The Forest will coordinate with state and federal agencies to reduce impacts to air quality and loss of energy resources due to the flaring of gas from oil wells. Generally, the Forest Service recommendation will be to only allow flaring during production testing of wells and to require either connection to a pipeline or reinjection once production is established. Exceptions would be considered in some situations such as where low volumes of gas are being produced and where there is limited or no opportunity to connect to a pipeline or to reinject.*

Emissions such as H₂S, and SO₂ from oil and gas development, and other mineral development activities are primarily regulated by other agencies and the state. Information will be provided as needed to the using public to identify hydrogen sulfide hazards from oil production.

- 3) *The objective is to maintain air quality at or above levels required by federal and state laws, regulations, and standards. Air that passes over National Forest System lands will not be degraded below allowable increments by activities under Forest Service control. State and local governments and appropriate federal agencies will also be consulted and involved in monitoring and controlling air pollution originating on nonfederal lands and affecting air quality on federal lands. Standards developed in the Cooperative Smoke Management Plan will be used for prescribed burning activities in the applicable states.*

- *Specific Implementation Considerations -*

- 1) *What are the long-term effects of non-lethal levels of H₂S and SO₂ from oil and gas development activities on the environment and resources uses and how far ranging in time and area are these effects? (USFS 1987, p. 4-6, 8-9, 11, 25-27, 30, 40, Table IV-1)*

Existing oil and gas development activities are in compliance with these air quality goals and objectives.

3.12.2 ENVIRONMENTAL CONSEQUENCES

In this section, the potential air quality effects associated with the alternative leasing scenarios are assessed. Estimated maximum emissions rates are compared to existing state and federal analysis and applicability thresholds to determine the potential for substantial direct effects. Other types of air quality effects such as indirect and cumulative effects are also addressed. In some instances, a thorough analysis of effects can only be addressed in a qualitative context. More specific analyses would be required to be conducted upon granting of leases and the submittal of specific plans for development by the lease holder.

Air quality effects can be categorized into the following general areas:

- Direct effects
- Indirect effects
- Cumulative effects

Within each of the categories above, there can be emissions from project-related activities that result in either cumulative effects, short- and/or long-term effects, and irreversible and/or irretrievable effects. Table 3.12-8 presents a summary of the relationships arising from potential project emissions.

The above types of emissions and effects are discussed for each alternative development scenario. In addition, for each scenario, consistency with the Forest Plan's air quality element is discussed, and where applicable, mitigation measures are proposed to reduce potential effects.

Potential scenario emissions were compared to the following significance thresholds derived from the applicable state and federal air quality regulations.

Table 3.12-8. Categories of Air Quality Effects

Impact Category	Potential Causes
Direct	<ul style="list-style-type: none"> • Road construction • Well pad development/construction • Well drilling/exploration • Well testing/flaring • Well operation and maintenance
Indirect	<ul style="list-style-type: none"> • Vehicle traffic associated with construction and well pad development • Vehicle traffic associated with well operations and maintenance
Cumulative	<ul style="list-style-type: none"> • Existing regional emissions plus O/G project emissions • Existing regional emissions, O/G project emissions, plus other future projects • Growth inducing effects from O/G projects

Table 3.12-9. Emissions Significance Thresholds

Regulatory Program	Pollutants	Significance Threshold
Prevention of Significant Deterioration DENR 74:36:09	NO _x , CO, SO _x , PM ₁₀ , VOC, Lead	<ul style="list-style-type: none"> • 100 tons per year (tpy) if source listed in Group of 28, otherwise, • 250 tpy
New Source Review DENR 74:36:10	NO _x , CO, SO _x , PM ₁₀ , VOC, Lead	<ul style="list-style-type: none"> • 100 tpy
Title V DENR 74:36:05	NO _x , CO, SO _x , PM ₁₀ , VOC, HAPs	<ul style="list-style-type: none"> • 100 tpy
Title IV DENR 74:36:16	SO _x and NO _x	<ul style="list-style-type: none"> • Source type and size
Title III DENR 74:36:05, 74:36:08 and CAA Section 112	HAPs	<ul style="list-style-type: none"> • 10 tpy of a single HAP, or, • 25 tpy of a combination of HAPs
New Source Performance Standards DENR 74:36:07	NO _x , CO, SO _x , PM ₁₀ , VOC, others	<ul style="list-style-type: none"> • Source type, size, and construction date
Minor Source Program DENR 74:36:04	NO _x , CO, SO _x , PM ₁₀ , VOC, HAPs	<ul style="list-style-type: none"> • Less than 100 tpy, exemptions apply per 74:36:04:03

It should be noted that the above significance thresholds apply primarily to stationary sources of air pollutants. In some instances, indirect and/or secondary emissions will be counted in the threshold determination for a stationary source.

Pursuant to discussions with DENR Air Staff and review of the DENR Air Quality Regulations, the following should be noted with respect to significance threshold determinations:

- Vehicle emissions are not subject to the above significance threshold values.
- Fugitive dust emissions from unpaved road construction or vehicle travel on such roads are not subject to the above significance threshold values.
- Emissions related to growth-inducing effects are not subject to the above significance threshold values. This applies insofar as a specific emissions increase is derived from a source not subject to DENR air regulations.
- Construction-related fugitive dust and construction equipment emissions are not subject to the above significance threshold values.

3.12.2.1 Alternative 1 - No Action, No New Leases

Under this alternative, no new leases would be granted, and only existing leases for producing wells would be allowed to continue past the expiration date of the current lease term. At present, based on information supplied in the RFD for the Sioux Ranger District, there are only four producing oil wells, and one injection well, within the boundary of the Harding County portion of the District. The following should be noted for these active wells:

- None of the wells are currently permitted by the DENR Air Division.

- The only source in Harding County that is currently inventoried by the DENR Air Division is a petroleum storage tank operation, which has emissions of volatile organic compounds on the order of less than 1 ton per year.
- Operational emissions of VOC from oil well sites, per data contained in the project record, are on the order of 0.28 lbs VOC/day, or approximately 103 lbs VOC/year. Emissions from the three existing wells would be approximately 0.84 lbs VOC/day, or 309 lbs VOC/year. These VOC emission rates are well below any permitting thresholds or significance values established pursuant to DENR air regulations, and would therefore be considered insubstantial.
- Continued operation of these wells will have no substantial effect on present or future air quality of the Harding County region.
- Based on discussions with BLM geology staff (North Dakota Field Office), expansion of activities at these sites is highly unlikely. BLM staff stated that if the resource, i.e., oil or gas, was present in a quantity that would be economically viable to pursue, expansion would have already occurred. Additionally, these leases may be further constrained, with respect to expansion, by state spacing orders. (Personal communication with Lee Jefferis, Geologist, BLM-North Dakota Field Office, July 26, 2002.)

Notwithstanding the above, the following projections were used in the Alternative 1 analysis:

- The existing leases would continue as long as the wells are producing. In addition, the RFD-projected wells within the existing lease boundaries would occur. As a result, there would be one producing oil well and one injection well added to the two producing oil wells and one injection well in the North Cave Hills unit, and two producing oil wells and one injection well added to the one producing oil well in South Cave Hills, i.e., an approximate total of five to six new wells.

Direct Effects

At present, the direct effects of the existing wells would be associated with an insubstantial amount of VOC emissions derived from leaking valves and flanges at the particular well sites. These emissions would persist until closure of the site. These emissions are insubstantial. Additionally, there are presently no established state or federal air quality standards for VOCs. VOC emissions are considered as precursors to ozone formation. Current EPA guidelines pertaining to new or modified sources located in attainment areas require an ambient impact analysis for VOC emissions increases at levels of greater than 100 tons per year. This analysis threshold applies on a source-by-source basis. VOC emissions as delineated above, on a site-by-site basis, are approximately 0.052 tons per year, which is three to four orders of magnitude below the required analysis thresholds. As such, the emissions would, (1) have no quantifiable effect on the existing ozone standard, (2) the region would continue to be attainment for the ozone standard, and (3) the emissions would not cause a violation of the ozone standard.

Indirect Effects

Indirect effects for the existing well sites would be comprised of vehicle emissions associated with the periodic site visits and maintenance activities. These emissions would also include fugitive dust emissions from unpaved road vehicle travel, if any of these wells are presently served by such roads. These emissions would persist until closure of the well sites.

Cumulative Effects

The cumulative effects of localized pollutants would depend on the locations of potential future projects in the near vicinity of the existing well sites. Such an assessment can only be conducted at the time of the projected future project development analysis.

Emissions associated with the development of the five wells (three producing and two injection) on current leases would be as follows:

Table 3.12-10. Potential Effects at Existing Lease Sites

Activity/Phase	Emissions (per Well Site basis)
Construction/Drilling	Road Construction: 0.012 tons PM ₁₀
	Drill Pad Construction: 0.3 tons PM ₁₀
	Drilling/Exploration: < 6.0 tons all Pollutants
Flaring	Flaring: < 0.2 tons all Pollutants
Operation	< 1.0 ton/yr all Pollutants

Emissions from the existing wells, both direct and indirect, are insubstantial. Based on the ozone analysis thresholds presented earlier, and the level of long-term operational VOC emissions for the additional well sites (<0.3 tons/yr), it is highly unlikely that emissions from the predicted additional wells on current leases, if developed, would have a cumulative effect on existing or future air quality, or would jeopardize the attainment or maintenance of any state or federal ambient air quality standard.

Irreversible/Irretrievable Effects

The current wells would not produce any irreversible or irretrievable air quality effects. The air quality in the project is in attainment for all state and federal air quality standards. Well closure would result in a reduction of an insubstantial amount of VOC and fugitive particulate matter (PM₁₀) emissions, and the air quality in the vicinity would essentially return to its pre-project condition.

Consistency with Forest Plan Air Quality Element

The Forest Plan Air Quality element generally calls for the management of resources in such a manner as to ensure the protection of air quality related values and compliance with ambient air quality standards. In addition, the Forest Service will work cooperatively with state and federal air agencies to assure these standards are met.

The existing well sites would be in compliance with the Forest Plan Air Quality element based on the following:

- The region is currently attainment for state and federal ozone standards.
- Emissions of VOCs from existing wells are well below any established state or federal permitting or impact analysis thresholds.
- Emissions of VOCs from projected wells at existing development sites would also be insubstantial, i.e., well below any established state or federal permitting or analysis thresholds.

3.12.2.2 Alternative 2 - Lease with Forest Plan Stipulations

This alternative projects an increased level of oil and gas development on Forest Service managed units over the projected planning period. This development would occur pursuant to the Forest Plan oil and gas stipulations, and in compliance with the Forest Plan Air Quality goals and objectives. The level of development is delineated as follows:

- Forecast approximately 28 new wells to be drilled during the planning period (15 years).
- Development of wells will proceed at a rate of one to two wells per year.

For purposes of the Alternative 2 analysis the following development was assumed, per the RFD:

- Six producing oil wells and six injection wells in North Cave Hills, and seven producing oil wells and three injection wells in South Cave Hills. One of the injection wells in South Cave Hills is projected to be off-Forest. Other projected wells include three dry wells in the Slim Buttes, one dry well in the East Short Pines, and one dry well and one producing gas well in the West Short Pines.

Air Quality Effects

Since oil and gas development projects within Harding County, regardless of the location, will impact air quality resources in the region, this alternative analysis considers the effects from two scenarios, i.e., development on Forest Service managed units, and development on non-Forest Service lands. Emissions from oil and gas development activities for an individual site can generally be broken down as follows:

Table 3.12-11. Emissions Associated with Oil/Gas Development

Emission Source	Impact Category	Emission Type
Road Construction	Direct Effects	Road Construction Dust
	Indirect Effects	Construction equipment exhaust
Drill Pad Construction	Direct Effects	Pad Construction Dust
	Indirect Effects	Construction equipment exhaust
Const. Worker Vehicles	Indirect Effects	Vehicle exhaust
Drill Rig Emissions	Direct Effects	Drill rig engine exhaust

Table 3.12-11. Emissions Associated with Oil/Gas Development (cont'd)

Emission Source	Impact Category	Emission Type
Flaring Emissions	Direct Effects	Well testing, flaring
Operations Vehicles	Indirect Effects	Vehicle exhaust Unpaved road dust
Operations Emissions	Direct Effects	Stationary site equipment

Detailed emissions estimates for the above emissions sources for a single site development scenario are contained in the project record. Data for multiple site development is scaled from the single site data. Table 3.12-12 presents the emissions estimates for the single site development scenario.

Regulatory Significance

This section presents a brief description of the regulatory significance of the emissions from each source category listed in Table 3.12-12.

Road Construction—PM₁₀ dust emissions and construction equipment exhaust emissions from road construction projects are not subject to the various significance thresholds delineated above. Construction or upgrade of well site access roads is most likely not a substantial activity in a sparsely populated rural area, in which the air quality currently meets the state and federal standards. Mitigation such as watering and speed control will reduce emissions from such temporary projects to levels that would not be expected to impact ambient air quality on both the short- or long-term standards.

Table 3.12-12. Development Emissions Estimates

Emission Source	Single Well Development Emissions Estimate
Road Construction	<ul style="list-style-type: none"> • PM₁₀ - 0.012 tons per construction period • < 0.5 tons of NO_x, CO, SO_x, VOC, PM₁₀ combined from construction equipment exhaust
Drill Pad Construction	<ul style="list-style-type: none"> • PM₁₀ - 0.3 tons per construction period • Construction equipment exhaust emissions included in road construction estimate (above)
Construction Worker Vehicles	<ul style="list-style-type: none"> • NO_x - 0.12 tons per construction period • CO - 1.0 tons per construction period • VOC - 0.12 tons per construction period • SO_x - 0.001 tons per construction period • PM₁₀ - 0.2 tons per construction period
Drill Rig Emissions	<ul style="list-style-type: none"> • NO_x - 4.7 tons per construction period • CO - 0.6 tons per construction period • VOC - 0.1 tons per construction period • SO_x - 0.1 tons per construction period • PM₁₀ - 0.2 tons per construction period

Table 3.12-12. Development Emissions Estimates (cont'd)

Emission Source	Single Well Development Emissions Estimate
Flaring Emissions	<ul style="list-style-type: none"> < 0.2 tons of NO_x, CO, VOC, and PM₁₀ combined for the 30-day flaring period
Operations Vehicles	<ul style="list-style-type: none"> < 1 ton per year for NO_x, CO, SO_x, VOC, and PM₁₀ combined (includes PM road fugitives)
Operations Emissions	<ul style="list-style-type: none"> < 0.1 tons per year of VOC

Drill Pad Development—PM₁₀ dust emissions and construction equipment exhaust emissions from drill pad leveling and development are not subject to the various significance thresholds delineated above. Construction of drill pads is most likely not a substantial activity in a sparsely populated rural area, in which the air quality currently meets the state and federal standards. Mitigation such as watering and speed control will reduce emissions from pad construction to levels that would not be expected to impact ambient air quality on both the short- or long-term standards.

Construction Worker Vehicle Emissions—Vehicle exhaust emissions, which result from construction worker travel to and from the well site location, are not subject to the various significance thresholds delineated above. A major portion of these emissions will occur away from the actual well site. In addition, a portion of these emissions would occur within the regional area in spite of the potential well projects, as a result of the available work force traveling to other ongoing construction or employment locations.

Drill Rig Emissions—Drilling rig emissions, although temporary, may be subject to the DENR air permitting regulations as a result of the engines on the rigs being classified as portable units. Portable units that have emissions in excess of 2 tons per year are not exempt from the minor source provisions of the DENR air regulations. Emissions from the drill rigs over a typical drilling period are well below the various emissions significance thresholds delineated in Table 3.12-9, and it is unlikely that these emissions would cause any substantial effects on either short- or long-term air quality standards. For example, dispersion modeling conducted for NO_x emissions (most prominent emitted pollutant from the oil/gas rig scenario) from geothermal well drilling rigs equipped with three diesel fired engines indicates that the maximum annual NO₂ effects range from 2.3 to 2.9 ug/m². These effects represent approximately 2.3 to 2.9 percent of the annual NO₂ standard of 100 ug/m³. In addition, these effects are well below the NO₂ significant monitoring concentration value of 14 ug/m³ stated in the federal PSD program.

Additionally, it should be noted that sulfur dioxide (SO₂) and hydrogen sulfide (H₂S) emissions from well drilling or blowouts are not quantified herein. Blowout emissions are highly variable, and the frequency of blowouts is rare for wells using modern drilling and exploration techniques. The presence of SO₂ and H₂S has not been found to be a problem for wells drilled in Harding County.

Flaring Emissions—Emissions from gas flaring are insubstantial and do not exceed the threshold values delineated above. These emissions, like most of the well site emissions, are typically temporary in nature, although some development sites do use flares on a continuous basis where

gas production from wells is insufficient to justify collection and distribution. The emission values used herein assume that the well developed is a viable producing gas well, and that flaring only occurs subsequent to well drilling for a period not to exceed 30 days.

Site Operational Emissions—Subsequent to drilling, an individual well site and access road will produce an insubstantial amount of operational emissions from the following sources: (1) VOC fugitives from valves and flanges, (2) vehicular-related emissions resulting from the daily site visits, and (3) fugitive dust emissions from vehicle travel over the site access road on a daily basis. These emissions in total are less than 1 ton per year. Actual stationary source site emissions are approximately less than 0.1 tons per year of VOCs. At this rate, an individual site would be exempt from the minor source provisions of the DENR air regulations, and the resultant emissions would not result in any substantial effects to local or regional air quality. Site operational emissions are based on the use of electric driven pumps and support equipment. It is unlikely that site pumps or other related equipment would be powered by internal combustion engines, as the use of such engines would result in the following:

- Increased site maintenance and oversight.
- Need for on-site fuel storage and delivery.
- Increased site potential for fuel spills resulting in surface or water resource contamination.

Direct Effects

At present, the long-term direct effects of the projected well development activities would be associated with an insubstantial amount of VOC emissions derived from leaking valves and flanges at the particular well sites. These emissions would persist until closure of the site. The emissions for a single site are on the order of less than 0.1 tons VOC per year. Total annual operational VOC emissions from all 28 potential well sites would be approximately 3 tons per year. At this level, the cumulative VOC emissions, on an annual basis, would represent approximately three percent of the new source analysis threshold (ozone effects due to VOC emissions) of 100 tons per year. Additionally, total VOC emissions on the order of 3 tons per year are well below the stated significance threshold values as delineated in Table 3.12-9. Long-term VOC emissions increases from the projected well sites will have no substantial effect on regional air quality and compliance with all air quality standards will be maintained.

Dispersion modeling of long-term VOC emissions was not undertaken for the following reasons:

- VOC emissions are well below the established permitting and impact significance levels.
- No State or federal air quality standard exists for VOC.
- VOC impact analyses for ozone effects are not required by the EPA if the individual new source VOC emissions are less than 100 tons per year.
- Currently, there is no EPA approved single source ozone impact model. Airshed ozone impact models do exist, but the cost and undertaking of an airshed ozone analysis is well beyond the scope and budget of this EIS.

Table 3.12-13 presents a summary tabulation of expected short- and long-term cumulative emissions for the potential development of 28 total wells.

Table 3.12-13. Emissions Summary for Alternative 2 Potential Well Development Scenario*

Emission Source	Short-Term Non-Cumulative Emissions	Long-Term Cumulative Emissions
Road Construction	<ul style="list-style-type: none"> • ~0.4 tons of PM₁₀ construction dust • ~14 tons of NO_x, CO, VOC, and PM₁₀ combined construction equipment exhaust 	NA
Drill Pad Construction	<ul style="list-style-type: none"> • ~8.4 tons PM₁₀ construction dust 	NA
Construction Worker Vehicle Exhaust	<ul style="list-style-type: none"> • ~3.36 tons NO_x • ~28.0 tons CO • ~3.36 tons VOC • ~0.03 tons SO_x • ~5.6 tons PM₁₀ 	NA
Drill Rig Emissions	<ul style="list-style-type: none"> • ~132 tons NO_x • ~16.8 tons CO • ~2.8 tons VOC • ~2.8 tons SO_x • ~5.6 tons PM₁₀ 	NA
Flaring Emissions	<ul style="list-style-type: none"> • ~5.6 tons of NO_x, CO, VOC, SO_x, and PM₁₀ combined 	NA
Operation Vehicles	NA	<ul style="list-style-type: none"> • < 28 tons/yr of NO_x, VOC, CO, and PM₁₀ combined
Operation Emissions	NA	<ul style="list-style-type: none"> • < 3 tons/yr of VOC

* Assumes a 15-year development period.

Indirect Effects

Long-term indirect effects for the projected well site developments would consist of vehicle emissions associated with the periodic site visits, and maintenance activities. These emissions would also include fugitive dust from unpaved road vehicle travel, if any of these wells are served by such roads. These emissions would persist until closure of the well sites.

Short-term indirect effects would consist of temporary emissions related to construction activities. Emissions during the construction period would result from: (1) fugitive dust emissions from road and well pad construction, (2) exhaust emissions from construction equipment and vehicle traffic associated with construction employment traffic, and (3) temporary flaring emissions subsequent to well drilling.

Regional Haze Impacts

Regional haze is defined as visibility impairment that is caused by the emission of air pollutants from numerous sources located over a wide geographic area. Such sources include, but are not limited to, major and minor stationary sources, mobile sources, and area sources. Emissions

from these sources and activities can span broad geographic areas and can be transported great distances. As a result, haze can and does occur throughout the nation.

The EPA issued a comprehensive set of regulations on July 1, 1999 (*Regional Haze Regulations, Final Rule*, 40 CFR 51) that are designed to improve visibility, or visual air quality, in 156 national parks and wilderness areas across the country. These regulations address visibility impairment in the form of regional haze, and require states to establish goals for improving visibility in national parks and wilderness areas, and to develop long-term strategies for reducing emissions of air pollutants that cause visibility impairment.

Pursuant to 40 CFR 51.300(b)(2), South Dakota is deemed an applicable state by virtue of the location of Wind Cave National Park and the Badlands Wilderness within the State boundary. Pursuant to the regulations, each state must submit an implementation plan revision that meets the requirements of the regulations. South Dakota DENR is currently in the process of developing the required SIP submittal for regional haze (personal communication, R. Boddicker, Senior Scientist, South Dakota DENR-Air Section, Pierre, SD, October 2002). The South Dakota plan will contain the following elements to address the program core requirements:

- Reasonable progress goals.
- Calculations of baseline and natural visibility conditions.
- Long-term strategy for regional haze.
- Monitoring strategy and other SIP requirements.

Impacts on regional haze from oil and gas development and operational activities will be insubstantial due to the following:

- Regional haze strategies are primarily targeted towards major sources, i.e, sources having actual or potential emission in excess of 100/250 tons per year pursuant to the NSR and PSD regulations.
- Oil and gas activities evaluated herein do not have actual or potential emission of any pollutant in excess of the major source thresholds. This is the case for individual well site development activities and operations as well as the long-term cumulative emissions for the Alternative 2 development scenario.

Cumulative Effects

The cumulative effects of localized pollutants would depend on the locations of potential future projects in the near vicinity of the existing well sites. Emissions from the existing wells, both direct and indirect, are insubstantial, and it is highly unlikely that such emissions would have a cumulative effect when addressed in any cumulative analysis for potential future projects. Anticipated site emissions for projected wells (direct long-term effects) are insubstantial. At less than 0.1 tons VOC per year per site, the development of 28 wells on Forest Service managed units would result in localized effects on the order of 3 tons VOC per year respectively. These values would most likely not occur until after the last well is brought into production mode at the end of the 15-year planning period. Additionally, as stated above, a cumulative emissions increase of 3 tons per year from well operational emissions is well below the permitting and

substantial impact thresholds delineated in Table 3.12-9. Vehicular emissions associated with the well sites are also insubstantial. Estimated vehicular emissions for a single well site are less than 1 ton per year of all pollutants combined. For 28 potential well sites, at full development, the cumulative increase would be approximately 28 tons per year (all pollutants combined). Vehicular emissions are not subject to the permitting or impact significance thresholds delineated in Table 3.12-9. Furthermore, 28 tons per year (all pollutants combined) represents approximately 0.077 tons per day increase. In order to establish whether this level of combined daily emissions is substantial, a comparison was made to the combined daily vehicular emissions single project substantial development thresholds used in southern California non-urbanized areas, i.e., 0.51 tons per day (all pollutants combined). Use of this significance criteria results in the full development (28 wells) vehicular emissions accounting for approximately 15 percent of the significance level. Comparing a single well site vehicular emissions to the significance value as intended by the South Coast Air District (under its California Environmental Quality Act provisions) (SCAQMD 1993) results in a single site value of 0.54 percent of the significance level, i.e., insignificant vehicular emissions for both a single project and all 28 projected well sites.

Irreversible/Irretrievable Effects

The projected wells would not produce any irreversible or irretrievable air quality effects. The air quality in the project is in attainment for all State and federal air quality standards. Well closure would result in a reduction of an insubstantial amount of VOC and fugitive particulate matter (PM₁₀) emissions, and the air quality in the vicinity would essentially return to its pre-project condition.

Growth Inducing Effects

It is unlikely that the level of projected well development over the 15-year planning period as stated in the RFD would result in any quantifiable growth inducing effects on the following areas:

- Housing and Transportation Services
- Public or Social Services
- Medical Services
- Infrastructure Improvements

Construction activity for individual wells will be short-lived and sporadic. As such, this will negate the need for a permanent work force in the area and related support services. Operational requirements for individual wells will not be work force or resource intensive, and could be supplied from nearby urban areas thus negating the need for local increases in services or work force growth.

Consistency with Forest Plan Air Quality Element

The Forest Plan Air Quality element (USFS 1987, p. 4, 26) generally calls for the management of resources in such a manner as to ensure the protection of air quality related values and

compliance with ambient air quality standards. In addition, the Forest Service will work cooperatively with state and federal air agencies to assure these standards are met.

Projected oil and gas well development will be required to be in compliance with the Forest Plan goals and objectives as related to air quality (USFS 1987, p. 26). Consistency with the Forest Plan will be achieved by (1) consultation with DENR Air Division staff on source permitting and compliance requirements, (2) incorporation of specific well development projects into the State air quality management plan (AQMP) where deemed necessary, and (3) conducting a sufficient pre-project siting analysis based on applicable DENR air regulations to ensure that air quality is protected within the project region, including any Class I areas.

3.12.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

This alternative anticipates a slightly decreased level of oil and gas development on Forest Service managed units over the projected planning period as compared to Alternative 2. This development would occur pursuant to the Forest Plan oil and gas stipulations, additional Alternative 3 stipulations as delineated in Chapter 2 and in compliance with the Forest Plan Air Quality goals and objectives. The level of development is delineated in the RFD, as follows:

- Forecast approximately 19 new wells to be drilled during the planning period (15 years).
- Development of wells will proceed at a rate of one to two wells per year.

For purposes of the Alternative 3 analysis the following development was assumed, per the RFD:

- Three producing oil wells and two injection wells all in off-Forest associated with North Cave Hills. Seven producing oil wells and two injection wells in South Cave Hills. Several of the wells in South Cave Hills are projected to be off-Forest. Other projected wells include two dry wells in off-Forest associated with Slim Buttes, one dry well in the East Short Pines, and one producing gas well and one dry hole in the West Short Pines.

North Cave Hills and Slim Buttes will be NSO; therefore, no new well development will occur in these areas under Alternative 3. As a result, the wells delineated above for these two areas may be developed off-forest.

Impacts

Short-term impacts for Alternative 3 on a per site and annual basis would be essentially the same as Alternative 2. Long-term impacts of Alternative 3 would be less than those delineated in Alternative 2, due to the projected number of wells decreasing from 28 to 19 under Alternative 3. It should be noted that development of wells off-Forest is assumed to have the same local and regional air quality impacts as on-forest development.

Direct Effects

At present, the long-term direct effects of the projected well development activities would be associated with an insignificant amount of VOC emissions derived from leaking valves and

flanges at the particular well sites. These emissions would persist until closure of the site. The emissions for a single site are on the order of less than 0.1 tons VOC per year. Total annual operational VOC emissions from all 19 potential well sites would be approximately 2 tons per year. At this level, the cumulative VOC emissions, on an annual basis, would represent approximately two percent of the new source analysis threshold (ozone effects due to VOC emissions) of 100 tons per year. Additionally, total VOC emissions on the order of 2 tons per year, is well below the stated significance threshold values as delineated in Table 3.12-9. Long-term VOC emissions increases from the projected well sites will have no substantial effect on regional air quality and compliance with all air quality standards will be maintained.

Dispersion modeling of long-term VOC emissions was not undertaken for the following reasons:

- VOC emissions are well below the established permitting and impact significance levels.
- No State or federal air quality standard exists for VOC.
- VOC impact analyses for ozone effects are not required by the EPA if the individual new source VOC emissions are less than 100 tons per year.
- Currently, there is no EPA approved single source ozone impact model. Airshed ozone impact models do exist, but the cost and undertaking of an airshed ozone analysis is well beyond the scope and budget of this EIS.

Table 3.12-14 presents a summary tabulation of expected short- and long-term cumulative emissions for the potential development of 19 total wells.

Table 3.12-14. Emissions Summary for Alternative 3 Potential Well Development Scenario*

Emission Source	Short-Term Non-Cumulative Emissions	Long-Term Cumulative Emissions
Road Construction	<ul style="list-style-type: none"> • ~0.3 tons or PM₁₀ construction dust • ~9.5 tons of NO_x, CO, VOC, and PM₁₀ combined construction equipment exhaust 	NA
Drill Pad Construction	<ul style="list-style-type: none"> • ~5.7 tons PM₁₀ construction dust 	NA
Construction Worker Vehicle Exhaust	<ul style="list-style-type: none"> • ~2.3 tons NO_x • ~19.0 tons CO • ~2.3 tons VOC • ~0.02 tons SO_x • ~3.8 tons PM₁₀ 	NA
Drill Rig Emissions	<ul style="list-style-type: none"> • ~89.7 tons NO_x • ~11.4 tons CO • ~1.9 tons VOC • ~1.9 tons SO_x • ~3.8 tons PM₁₀ 	NA
Flaring Emissions	<ul style="list-style-type: none"> • ~3.8 tons of NO_x, CO, VOC, SO_x, and PM₁₀ combined 	NA

Table 3.12-14. Emissions Summary for Alternative 3 Potential Well Development Scenario*

Emission Source	Short-Term Non-Cumulative Emissions	Long-Term Cumulative Emissions
Operation Vehicles	NA	<ul style="list-style-type: none"> < 19 tons/yr of NO_x, VOC, CO, and PM₁₀ combined
Operation Emissions	NA	<ul style="list-style-type: none"> < 2 tons/yr of VOC

* Assumes a 15-year development period.

Indirect Effects

Long-term indirect effects for the projected well site developments would consist of vehicle emissions associated with the periodic site visits and maintenance activities. These emissions would also include fugitive dust from unpaved road vehicle travel, if any of these wells are served by such roads. These emissions would persist until closure of the well sites.

Short-term indirect effects would consist of temporary emissions related to construction activities. Emissions during the construction period would result from: (1) fugitive dust emissions from road and well pad construction, (2) exhaust emissions from construction equipment and vehicle traffic associated with construction employment traffic, and (3) temporary flaring emissions subsequent to well drilling.

Regional Haze Impacts

Regional haze is defined as visibility impairment that is caused by the emission of air pollutants from numerous sources located over a wide geographic area. Such sources include, but are not limited to, major and minor stationary sources, mobile sources, and area sources. Emissions from these sources and activities can span broad geographic areas and can be transported great distances. As a result, haze can and does occur throughout the nation.

The EPA issued a comprehensive set of regulations on July 1, 1999 (*Regional Haze Regulations, Final Rule*, 40 CFR 51) that are designed to improve visibility, or visual air quality, in 156 national parks and wilderness areas across the country. These regulations address visibility impairment in the form of regional haze, and require states to establish goals for improving visibility in national parks and wilderness areas, and to develop long-term strategies for reducing emissions of air pollutants that cause visibility impairment.

Pursuant to 40 CFR 51.300(b)(2), South Dakota is deemed an applicable state by virtue of the location of Wind Cave National Park and the Badlands Wilderness within the State boundary. Pursuant to the regulations, each state must submit an implementation plan revision that meets the requirements of the regulations. The South Dakota DENR is currently in the process of developing the required SIP submittal for regional haze (personal communication, R. Boddicker, Senior Scientist, South Dakota DENR-Air Section, Pierre, SD, October 2002). The South Dakota plan will contain the following elements to address the program core requirements:

- Reasonable progress goals.
- Calculations of baseline and natural visibility conditions.

- Long-term strategy for regional haze.
- Monitoring strategy and other SIP requirements.

Impacts on regional haze from oil and gas development and operational activities will be insubstantial due to the following:

- Regional haze strategies are primarily targeted towards major sources, i.e., sources having actual or potential emission in excess of 100/250 tons per year pursuant to the NSR and PSD regulations.
- Oil and gas activities evaluated herein do not have actual or potential emission of any pollutant in excess of the major source thresholds. This is the case for individual well site development activities and operations as well as the long-term cumulative emissions for the Alternative 3 development scenario.

Cumulative Effects

The cumulative effects of localized pollutants would depend on the locations of potential future projects in the near vicinity of the existing well sites. Emissions from the existing wells, both direct and indirect, are insubstantial, and it is highly unlikely that such emissions would have a cumulative effect when addressed in any cumulative analysis for potential future projects. Anticipated site emissions for projected wells (direct long-term effects) are insubstantial. At less than 0.1 tons VOC per year per site, the development of 19 wells on or off of Forest Service managed units would result in localized effects on the order of 2 tons VOC per year respectively. These values would most likely not occur until after the last well is brought into production mode at the end of the 15-year planning period. Additionally, as stated above, a cumulative emissions increase of 2 tons per year from well operational emissions is well below the permitting and significant impact thresholds delineated in Table 3.12-9. Vehicular emissions associated with the well sites are also insignificant. Estimated vehicular emissions for a single well site are less than 1 ton per year of all pollutants combined. For 19 potential well sites, at full development, the cumulative increase would be approximately 19 tons per year (all pollutants combined). Vehicular emissions are not subject to the permitting or impact significance thresholds delineated in Table 3.12-9. Furthermore, 19 tons per year (all pollutants combined) represents approximately 0.05 tons per day increase. In order to establish whether this level of combined daily emissions is significant, a comparison was made to the combined daily vehicular emissions single project significant development thresholds used in southern California non-urbanized areas, i.e., 0.51 tons per day (all pollutants combined). Using this significance criteria results in the full development (19 wells) vehicular emissions accounting for approximately 10 percent of the significance level. Comparing a single well site vehicular emissions to the significance value as intended by the South Coast Air District (under its California Environmental Quality Act provisions) (SCAQMD 1993) results in a single site value of less than 0.4 percent of the significance level, i.e., insignificant vehicular emissions for both a single project and all 19 projected well sites.

Irreversible/Irretrievable Effects

The projected wells would not produce any irreversible or irretrievable air quality effects. The air quality in the project is in attainment for all State and federal air quality standards. Well

closure would result in a reduction of an insignificant amount of VOC and fugitive particulate matter (PM₁₀) emissions, and the air quality in the vicinity would essentially return to its pre-project condition.

Growth Inducing Effects

It is unlikely that the level of projected well development over the 15-year planning period as stated in the RFD would result in any quantifiable growth inducing effects on the following areas:

- Housing and Transportation Services
- Public or Social Services
- Medical Services
- Infrastructure Improvements

Construction activity for individual wells will be short lived and sporadic. As such, this will negate the need for a permanent work force in the area and related support services. Operational requirements for individual wells will not be work force or resource intensive, and could be supplied from nearby urban areas thus negating the need for local increases in services or work force growth.

Consistency with Forest Plan Air Quality Element

The Forest Plan Air Quality element generally calls for the management of resources in such a manner as to ensure the protection of air quality related values and compliance with ambient air quality standards. In addition, the Forest Service will work cooperatively with state and federal air agencies to assure these standards are met.

Projected oil and gas well development will be required to be in compliance with the Forest Plan goals and objectives as related to air quality. Consistency with the Forest Plan will be achieved by (1) consultation with DENR Air Division staff on source permitting and compliance requirements, (2) incorporation of specific well development projects into the State air quality management plan (AQMP) where deemed necessary, and (3) conducting a sufficient pre-project siting analysis based on applicable DENR air regulations to ensure that air quality is protected within the project region, including any Class I areas.

Alternative 3 Stipulations

The following additional lease notices are required to further minimize emissions and air quality effects from oil and gas well development projects under Alternative 3. These lease notices focus primarily on reducing emissions of PM₁₀ (fugitive dust) and operational emissions of VOCs. Each projected well development project will be required to determine the significance of fugitive dust emissions and implement the control measures necessary to minimize such emissions. Additionally, each project will be required to consult with the South Dakota DENR Air Division concerning the need for applicable permits, compliance requirements, and monitoring and record keeping requirements.

Construction Lease Notices:

- If on-site electricity is available, electric drill rigs will be used.
- During clearing, grading, earth moving, or excavation operations, excessive fugitive dust emissions must be controlled by one or more of the following techniques: (1) regular watering, (2) speed control, (3) use of dust palliative or soil stabilization agents, or (4) paving.
- All material excavated or graded must be sufficiently watered to prevent excessive amounts of fugitive dust. Watering must occur at least twice daily with complete coverage. Timing must be consistent with DENR Air Division recommendations.
- All clearing, grading, earth moving, or excavation activities must cease when site wind speed conditions exceed 20 mph averaged over a 1-hour period.
- All material transported off-site must be covered or sufficiently watered to prevent fugitive dust emissions during transport.
- Pre-construction planning must identify the areas to be disturbed and what measure will be implemented to minimize the disturbance areas.
- After construction, fugitive dust from active disturbed areas must be minimized by watering on a periodic basis, but at least twice daily.
- After construction, fugitive dust from inactive disturbed areas must be minimized by seeding and watering the area to promote ground cover growth.

Operational Lease Notices:

- Prior to project startup, the Forest Service will require substantiation that the developer has consulted with the State DENR Air Division on issues related to air quality permits, compliance, monitoring, and record keeping requirements.
- Electric power must be brought to the site as soon as possible after well production begins.
- Electric pumps must be used whenever possible.
- Vehicle speeds on access roads and on-site will be limited to 15 mph or less.
- Equipment engines must be maintained in good working condition and properly tuned per the manufacturer's specifications.
- Periodic site inspections will identify worn or leaking valves and flanges, and repairs must commence on such items as soon as possible.
- Whenever possible, site access roads must be "use" restricted or secured to prevent non-essential vehicle travel.

3.13 ISSUE 12: RILEY ABANDONED URANIUM MINE

3.13.1 AFFECTED ENVIRONMENT

3.13.1.1 Radiation Hazards

Radiation is energy that travels in the form of waves or particles. Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to change them chemically, is referred to as "non-ionizing radiation." Examples of this kind of radiation are sound waves, visible light, and microwaves. However, the word "radiation" in this document refers to the types of radiation that have enough energy to break chemical bonds, and are referred to as "ionizing radiation."

Radiation causes ionization, which is the process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions. High temperatures, electrical discharges, or nuclear radiation can cause ionization in the molecules of living cells. This ionization results in the removal of electrons from the atoms, forming ions or charged atoms. The ions formed can go on to react with other atoms in living cells, causing damage.

At low doses, such as what humans receive every day from background radiation, cells can repair the damage rapidly. At higher doses (up to 100 rem), cells may not be able to repair the damage, and the cells may either be changed permanently or die. Most cells that die are of little consequence, as the body can simply replace them. However, cells that are permanently changed may go on to produce abnormal cells when they divide. In the right circumstance, these cells may become cancerous.

Cancer is considered to be the primary health effect from radiation exposure. Simply put, cancer is the uncontrolled growth of cells. Ordinarily, natural processes control the rate at which cells grow and replace themselves. They also control the body's processes for repairing or replacing damaged tissue. Damage occurring at the cellular or molecular level can disrupt the body's normal control processes, permitting the uncontrolled growth of cancerous cells. Thus, the ability of ionizing radiation to break chemical bonds in atoms and molecules makes it a hazard.

3.13.1.2 North Cave Hills

Conditions at the Riley Pass Mine present an imminent and substantial endangerment to human health and the environment, mainly due to exposure and erosion of contaminated soils associated with uranium mining. These conditions meet the criteria for initiating a removal action under 40 CFR Section 300.415 (b)(2) of the National Contingency Plan (NCP).

The Forest Service is currently preparing an Engineering Assessment/Cost Analysis (EE/CA) for a removal action of the Riley Pass Mine site spoil piles. The most likely alternative is to cap the spoil piles and to minimize surface migration and infiltration of precipitation.

The Riley abandoned uranium strip mines are located in the North Cave Hills area of Harding County, South Dakota. The Sioux Ranger District of the Custer National Forest primarily administers the mines, but a small fraction is also situated on private land. The mines cover approximately 250 acres of highwalls, pit floor, and spoils in Sections 20, 21, 22, 23, 25, 26, 27,

29, 35, and 36 of Township 22 North, Range 5 East of the Black Hills Meridian (Table 3.13-1) and for purposes of identification are broken into 12 bluffs. The sites are bordered by USFS, private, and BLM lands. (Pioneer Technical Services 2002.)

Table 3.13-1. Bluff Identification

Bluff Identification	Legal Description	Land Ownership
A and B	T22N, R5E, Sec. 22	USFS
H	T22N, R5E, Sec. 25	Private
B, C, D, and E	T22N, R5E, Sec. 26	Partial USFS, Partial Private
B	T22N, R5E, Sec. 27	USFS
E, F, and I	T22N, R5E, Sec. 35	USFS
G, H, and I	T22N, R5E, Sec. 36	USFS (bordered on east in Sec. 31 22N, 6E by BLM)
J	T22N, R5E, Sec. 20	USFS
K	T22N, R5E, Sec. 21	USFS
L	T22N, R5E, Sec. 29	USFS

Site elevations typically range from approximately 3,100 to 3,400 feet above mean sea level (amsl). The sites are identified in orange denoting No Lease on Figure 2.25 in the map packet.

3.13.1.3 Regional Setting

The Riley Pass Mine area is situated on a divide in the North Cave Hills that separates the Schleichart Draw/Campbell Creek drainage and the Crooked Creek/Pete's Creek drainage. Schleichart Draw, which runs south from Riley Pass, drains the western and southern portions of the site, and Pete's Creek, which runs northeast, drains the eastern and northern portion of the site. In the region of the mine, these streams are divided into tributary channels, most of which are ephemeral. (Pioneer Technical Services 2002.)

The area surrounding the abandoned mine site exhibits two distinct sandstone outcroppings, which appear as rimrock cliffs. The lower rimrock is the basal sandstone of the Tongue River member. This sandstone also creates the pit floor for past uranium mining. The sandstone is approximately 80 feet thick, nearly level, and somewhat fractured. The uranium-bearing lignite bed lies immediately above this sandstone. The stripped material is a heterogeneous mix of the Tongue River formation and interbedded rock types. (Pioneer Technical Services 2002.)

3.13.1.4 Waste Volumes

According to the Site Investigation Report (Pioneer Technical Services 2002), approximately 250 acres have been disturbed from past mining activities with an estimated spoils volume of 1,728,000 cubic yards (cy). Of this, Bluffs B and H show the most disturbances--150 acres and 31 acres respectively; the remaining bluffs have a disturbance area ranging from approximately 2 to 20 acres.

Bluff B

Bluff B is the largest disturbed area at the Riley Pass site. Bluff B encompasses approximately 150 acres, of which approximately 35 acres are spoils with an estimated volume of approximately 1,000,000 cy. The disturbed unvegetated area and the disturbed area with vegetation are 82 and 25 acres, respectively. Bluff B also has approximately six acres of exposed bedrock.

Bluff H

Bluff H is the second largest disturbed area at the site. Bluff H encompasses a disturbance area estimated at 31 acres, of which approximately 8 acres consist of spoils piles with an estimated volume of 490,000 cy. The disturbed unvegetated area and the disturbed area with vegetation are 21 and 2 acres, respectively.

Remaining Bluffs

Bluffs A, G, I, and L also have spoil piles, disturbed unvegetated areas, and/or disturbed vegetated areas; however, on a much smaller scale than Bluffs B and H. Bluff G also has approximately two acres of exposed bedrock.

Bluffs C, D, E, F, J, K₍₁₎, and K₍₂₎ have no spoil piles associated with them. These bluffs, however, do have disturbed areas with and without vegetation and exposed bedrock as shown in Table 3.13-2.

Table 3.13-2. Riley Pass Bluff Waste Types and Volumes

Bluff	Spoil Pile Volume (cy)	Spoil Pile Area (acre)	Disturbed Unvegetated Area (acre)	Disturbed Vegetated Area (acre)	Bedrock Area (acre)	Total Disturbed Area (acre)
Bluff A	21,000	1	2	NA	NA	3
Bluff B	1,000,000	37	82	25	6	150
Bluff C	NA	NA	1	9	NA	10
Bluff D	NA	NA	5	NA	NA	5
Bluff E	NA	NA	2	NA	NA	2
Bluff F	NA	NA	0.5	2.5	NA	3
Bluff G	56,000	2	0.5	0.5	2	5
Bluff H	490,000	8	21	2	NA	31
Bluff I ₍₁₎	110,000	4	5	9	NA	18
Bluff I ₍₂₎	16,000	0.5	2.5	1	NA	4
Bluff J	NA	NA	0.5	3.5	NA	4
Bluff K ₍₁₎	NA	NA	NA	2	NA	2
Bluff K ₍₂₎	NA	NA	1	4	NA	5
Bluff L	35,000	1	1	6	NA	8
Total	1,728,000	53.5	124	64.5	8	250

NA = Not Applicable; cy = Cubic Yards

3.13.2 ENVIRONMENTAL CONSEQUENCES

3.13.2.1 Alternative 1 - No Action, No New Leases

This alternative would not allow issuance of new leases, and only existing leases for producing wells would be allowed to continue past expiration of the current lease term. Since existing leases are allowed to continue and expand as long as they are producing, all the effects stated below for Alternative 1 are applicable to Alternatives 2 and 3 as well.

North Cave Hills

Direct Effects—An oil well adjacent to and southwest of Bluff B (NCH 14) was drilled in 1962 and currently produces an average of 42,000 barrels yearly (Pioneer Technical Services 2002). It is likely that there are brine pits and sludge pits that could be sampled and characterized. Current practices include the use of well-cased injection wells to return the wastes to their origin. Typically, produced waters entrain radium-226 and radium-228 that are precipitated in the brine pits. Trace metals are similarly entrained in the produced waters and precipitated in the brine pits. Some lesser quantities of aqueous phase precipitates can be found with the organics in the sludge pits. The organic compound hazards are well known, with the most potent carcinogens consisting of the polynuclear aromatic hydrocarbons (PAHs). Existing lease SDM 54158, shown on Figure 2.01 in the map packet, contains a portion of Bluff B at the north end of the lease block. Further development in that area could directly expose workers to increased health risks.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand picocuries per liter (pCi/L). Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the technologically enhanced naturally occurring radioactive material (TENORM) concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon.

Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

South Cave Hills

No effects.

Slim Buttes

No effects.

West Short Pines

No effects.

East Short Pines

No effects.

3.13.2.2 Alternative 2 - Lease with Forest Plan Stipulations

This alternative is a combination of Forest Plan oil and gas stipulations and development projections from the RFD.

North Cave Hills

Direct Effects—Prior uranium mining activities in the area indicate the presence of elevated levels of naturally occurring radioactive material (NORM). One can expect elevated TENORM concentrations. In addition, there is some probability that drilling may encounter ore zones. Five samples of the existing ore zones have been analyzed. The average uranium-238 concentration was reported to be 1,280 pCi/g and the radium-226 averaged 480 pCi/g. Those concentrations could be expected in core samples and would also lead to contamination of drilling mud.

The vast majority of the mines are in areas that would have no surface occupancy stipulations applied for other resource concerns if Alternative 2 were implemented. This can readily be seen by comparing the maps in Figures 2.25 and 2.07 in the map packet. There is a very small area of the mine in section 21 that is not NSO. Although the RFD does not project development there, development still could occur under the Alternative 2 leasing scenario at that location and expose workers to increased health risks.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically

ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells. Such contamination of ground water is not expected to occur given the small number of wells projected and the requirements of Title 36 Code of Federal Regulations (CFR) Part 228 and 43 CFR 3160 relative to maintenance of casing, environmental obligations, and protection of subsurface water.

Cumulative Effects—Since the technologically enhanced naturally occurring radioactive material (TENORM) concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

South Cave Hills

No effect.

Slim Buttes

No effect.

West Short Pines

No effect.

East Short Pines

No effect.

3.13.2.3 Alternative 3 - Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

This alternative will apply the Forest Plan oil and gas leasing stipulations; Forest Plan management goals, objectives, standards, and guidelines; and additional stipulations as discussed in Chapter 2.

Alternative 3 Mitigation—The additional Alternative 3 stipulations result in the entire North Cave Hills land unit being NSO. As a result, no additional leasing activities would occur on the surface within the Forest. While Alternative 2 results in NSO for most all of the mine sites, the NSO is based on other resource concerns. Likewise, in Alternative 3, all of North Cave Hills is NSO for other resource concerns. If it can be demonstrated that those resource concerns can be mitigated, those NSO stipulations might be waived, exempted, or modified (see Appendix B). As a result, it is important that these potential health risk areas have their own specific mitigation. Consequently, all of the mine sites are administratively not available for lease in Alternative 3.

Direct Effects—Since the entire NCH is NSO, the direct on-Forest impacts from the mine sites would be the same as in Alternative 1. This is true since the existing leases are permitted to continue as long as they are producing. An effect of North Cave Hills being entirely NSO in Alternative 3 is to displace well sites off-Forest. Five reasonably foreseeable off-Forest well sites have been projected for Alternative 3. These projected well sites have not been geographically located since non-federal lands are involved. However, they could potentially be located in sections 25 and 26 east of the Forest, where mine spoils occur on private lands, thus creating a potential exposure risk.

Indirect Effects—Indirect effects are expected to be similar to Alternative 2 and similarly mitigated.

Cumulative Effects—Since the technologically enhanced naturally occurring radioactive material (TENORM) concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

3.14 ISSUE 12A: ABANDONED URANIUM MINES

3.14.1 AFFECTED ENVIRONMENT

3.14.1.1 Radiation Hazards

Radiation is energy that travels in the form of waves or particles. Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to change them chemically, is referred to as "non-ionizing radiation." Examples of this kind of radiation are sound waves, visible light, and microwaves. However, the word "radiation" in this document refers to the types of radiation that have enough energy to break chemical bonds, and are referred to as "ionizing radiation."

Radiation causes ionization, which is the process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions. High temperatures, electrical discharges, or nuclear radiation can cause ionization in the molecules of living cells. This ionization results in the removal of electrons from the atoms, forming ions or charged atoms. The ions formed can go on to react with other atoms in living cells, causing damage.

At low doses, such as what humans receive every day from background radiation, cells can repair the damage rapidly. At higher doses (up to 100 rem), cells may not be able to repair the damage, and the cells may either be changed permanently or die. Most cells that die are of little consequence, as the body can simply replace them. However, cells that are permanently changed may go on to produce abnormal cells when they divide. In the right circumstance, these cells may become cancerous.

Cancer is considered to be the primary health effect from radiation exposure. Simply put, cancer is the uncontrolled growth of cells. Ordinarily, natural processes control the rate at which cells grow and replace themselves. They also control the body's processes for repairing or replacing damaged tissue. Damage occurring at the cellular or molecular level can disrupt the body's normal control processes, permitting the uncontrolled growth of cancerous cells. Thus, the ability of ionizing radiation to break chemical bonds in atoms and molecules makes it a hazard.

3.14.1.2 Regional Setting

Unlike ore (source material) and mill tailings (byproduct material), uranium overburden is not regulated by the Atomic Energy Act of 1954 or the Uranium Mill Tailings Remedial Action (UMTRA) program instituted by the EPA in 1978, and therefore is considered TENORM.

The uranium mining industry began in the 1940s primarily for the purpose of producing uranium ore for use in weapons and soon after for nuclear fuel fabrication. The majority of the mines are located in the west, mainly in Utah, Colorado, Wyoming, Arizona, South Dakota, New Mexico, and Texas. Mining of uranium ores by surface and underground methods produces large amounts of bulk material, including overburden, low-grade ore, and mining spoils. Surface mining produces the bulk of the spoils.

Overburden, which is beneath the top soil and overlies the ore deposit, contains limited amounts of natural uranium and its progeny; national average ^{226}Ra concentrations are 0.92 Bq/g (25 pCi/g) (EPA 1993).

Mining spoils include low-grade ore and other materials excavated during the mining process. Low-grade ore contains uranium but usually not in large enough quantities to make milling economically attractive. The concentrations of ^{226}Ra at the interface of overburden and low-grade ore boundaries vary from approximately 0.1 to ~10 Bq/g (three to several hundred pCi/g). (EPA 1993.)

The Montana Bureau of Mines and the Custer National Forest recently completed comprehensive inventories of abandoned mine sites in South Dakota. Of the approximately 900 inventoried sites, approximately 200 are located on U.S. Forest Service land and approximately 700 on private land. In an effort to prioritize the mines on National Forest System (NFS) lands, those sites (about 200) were subjected to a hazard screening for physical and environmental hazards.

Many abandoned mine sites pose physical safety, human health and/or environmental hazards, and are in need of cleanup. However, with regard to the total number of sites identified in the inventory, the number of sites that pose these various kinds of hazards is not known. Based on the information collected in the inventory, only the sites on NFS lands affected by oil and gas leasing have been included.

3.14.2 ENVIRONMENTAL CONSEQUENCES

3.14.2.1 Alternative 1 - No Action, No New Leases

This alternative would not allow issuance of new leases, and only existing leases for producing wells would be allowed to continue past expiration of the current lease term.

North Cave Hills

This discussion excludes any abandoned mine lands associated with the Riley Pass mine discussed in Issue 12, Section 3.13. The abandoned mines identified in the North Cave Hills are listed in Table 3.14-1.

Table 3.14-1. Abandoned Mines in North Cave Hills

Id	Name	Remarks
HA009039	Billy Dale Group / Kermac Operation	Strip mine, highwall ~60 to 80 feet high
HA009042	Bone / Kermac Operation	Bulldozer cut next to Susan Becky
HA009036	Hawkeye	No workings or disturbances found
HA009043	Hoop and Holler / Kalina Operation	Three small areas strip mined
HA009047	L&L No. 3 / Kermac Operation	Strip mine along plateau rim
HA009044	Last Chance / Kalina Operation	Cut in hillslope, re-vegetated
HA009062	Mink / Kermac Operation	Pond on mine bench sampled
HA009045	Peters Operation	

Table 3.14-1. Abandoned Mines in North Cave Hills (Cont'd)

Id	Name	Remarks
HA008571	Pickpocket / Munkers Operation	Pond on mine bench sampled
HA009040	Relf Mine / Kermac Operation	Strip mine on top of small butte
HA009041	Riley	No workings or disturbances found
HA009037	Snake Eye	No workings or disturbances found
HA009061	Susan Becky / Kermac Operation	Pond on mine bench sampled
HA008544	Travers Ranch	Seven small workings and prospects
HA009048	Tree Stump	General area visited, no workings found
HA009046	Windy Jim / Kermac Operation	Strip mine along plateau rim
HA009038	Yeb	Single bulldozer prospect

Direct Effects—Two wells (NCH01 and NCH05) are projected within existing leases. There are no additional direct radiological effects associated with this Alternative, since the projected wells in existing leases are adjacent to the Riley Pass mine site and discussed in Issue 12.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other

activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

South Cave Hills

The abandoned mines identified in the South Cave Hills are listed in Table 3.14-2.

Table 3.14-2. Abandoned Mines in South Cave Hills

Id	Name	Remarks
HA009050	Blue Jay	Small bulldozer cut, one prospect
HA009055	Bobcat Mine	General area visited, no workings found
HA009052	Daisy Mae No. 6	Small strip mine below plateau rim
HA009049	Eleanor	Two bulldozer prospects
HA008586	Jeffry Lynn	Prospects on top of butte
HA008628	Lonesome Pete No. 2	Revegetated mine bench 150x500 feet
HA009056	Margery	One small bulldozer cut, re-vegetated
HA009051	Marion	Three bulldozer cuts, end of ridge lines

This alternative would allow existing leases held by production to continue past expiration of the current lease term.

Direct Effects—Three new wells (SCH03, SCH06, and SCH10) within existing leases are projected for the South Cave Hills. These three wells are not located near any currently identified abandoned mine sites.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

Slim Buttes

The abandoned mines identified in the Slim Buttes are listed in Table 3.14-3.

Table 3.14-3. Abandoned Mines in Slim Buttes

Id	Name	Remarks
HA009027	Bob Cat	Four bulldozer prospects
HA009030	Buckhorn Group	No workings, road tracks in landslide area
HA009034	Cap 2	General area visited, no workings found
HA009029	Cat Tail 1 / Hanson Operation H-1	Strip mine, three digs
HA009058	Divide 1	No access, road washed out
HA009033	Hilltop Mine	No workings, center post found
HA009060	Hinds 1	No access, road washed out
HA009059	Moonshine 1	No access, road washed out
HA009024	Olesrud Bed	No workings or disturbances found
HA009026	Olesrud Mine	Single bulldozer prospect
HA009032	Rock Spring / Hanson Operation H-2	Revegetated mine bench
HA009035	Ruth Lode	General area visited, no workings found
HA009023	Square Top Butte	No workings or disturbances found

Direct Effects—No new wells are projected for existing leases.

Indirect Effects—No new wells are projected for existing leases.

Cumulative Effects—No new wells are projected for existing leases.

West Short Pines

No effect.

East Short Pines

No effect.

3.14.2.2 Alternative 2 - Lease with Forest Plan Stipulations

North Cave Hills

This alternative is combination of Forest Plan oil and gas stipulations and development projections from the RFD.

Direct Effects—Twelve new wells are projected for the North Cave Hills. The only direct effects relate to the physical hazards associated with personnel working near abandoned uranium mines. These abandoned mines have spoils piles that are not under any control, and can be accessible to oil and gas workers installing new wells.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can

be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

South Cave Hills

Direct Effects—Ten new wells are projected for the South Cave Hills. Several projected wells are located near identified abandoned mine sites. The only direct effects relate to the physical hazards associated with personnel working near abandoned uranium mines. These abandoned mines have spoils piles that are not under any control, and can be accessible to oil and gas workers installing new wells.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

Slim Buttes

Direct Effects—Three new wells are projected for the Slim Buttes. The only direct effects relate to the physical hazards associated with personnel working near abandoned uranium mines. These abandoned mines have spoils piles that are not under any control, and can be accessible to oil and gas workers installing new wells.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

West Short Pines

No effect.

East Short Pines

No effect.

3.14.2.3 Alternative 3 - Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

This alternative will apply the Forest Plan (FP) oil and gas leasing stipulations; Forest Plan management goals, objectives, standards, and guidelines; and additional stipulations as necessary to protect Forest resources.

North Cave Hills

Direct Effects—Five new wells off of NFS land are projected for the North Cave Hills area. The only direct effects relate to the physical hazards associated with personnel working near abandoned uranium mines. These abandoned mines have spoils piles that are not under any control, and can be accessible to oil and gas workers installing new wells.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other

activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

South Cave Hills

Direct Effects—Nine new wells are projected for the South Cave Hills. Several projected wells are located near identified abandoned mine sites. The only direct effects relate to the physical hazards associated with personnel working near abandoned uranium mines. These abandoned mines have spoils piles that are not under any control, and can be accessible to oil and gas workers installing new wells.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the

radon released from production and wastes will have daughter in-growth with increased inhalation dose.

Slim Buttes

Direct Effects—Two new wells off of NFS land are projected for the Slim Buttes area. The only direct effects relate to the physical hazards associated with personnel working near abandoned uranium mines. These abandoned mines have spoils piles that are not under any control, and can be accessible to oil and gas workers installing new wells.

Indirect Effects—Radium is brought to the surface with produced waters. Surface conditions and production operations result in precipitation of radium-bearing materials. These solids are deposited in pipes, heater-treaters (enhanced separation of water from hydrocarbons), tank batteries, and in temporary staging areas prior to disposal. Produced waters typically have radium concentrations of several thousand pCi/L. Precipitates have concentrations typically ranging from 100 to 20,000 pCi/g. Concentrations as high as 400,000 pCi/g have been reported. The concentrations of radium-226 and radium-228 in produced waters are a function of the contact of groundwater with thorium-232 and uranium-238 mineralization in the oil-bearing zone. Among other factors influencing concentrations in produced waters are the specific underground pathway (variable), the time duration of contact with the radium-bearing strata, the temperature (usually superheated above boiling with high pressure), and other geochemical and geophysical conditions.

A principle concern is maintenance of casing integrity to prevent the release of produced waters to useful ground water aquifers above the production zones. Any single oil well is not likely to cause substantial aquifer contamination due to the leaching of radium beneath the surface. However, aquifer contamination has been evident in oil fields with a large number of producing wells.

Cumulative Effects—Since the TENORM concentrations are variable, even on a daily basis, the only way to evaluate the potential radiation doses is to monitor with radiation detection instruments and to collect and analyze samples. Spending less time near the sources and remaining at some distance from them can mitigate worker radiation exposure to gamma ray emissions. Deposits can be wetted down to reduce entrainment of contaminated dust. Water can be a deterrent to off gassing of radon. Contamination control includes use of prophylactic gloves, disposable clothing, and the prohibition of eating, drinking, smoking, chewing, and other activities that might lead to incidental ingestion. Berms can be constructed to prevent surface water and sediment runoff.

Radon gas is emitted during production; however, there are only minor decay products (“radon progeny” or “daughters”) and the inhalation dose to workers is minimal. Further down wind, the radon released from production and wastes will have daughter in-growth with increased inhalation dose.

West Short Pines

No effect.

East Short Pines

No effect.

Alternative 3 Stipulations

Potential adverse effects from oil and gas leasing in areas associated with abandoned uranium mines would be mitigated through the following lease Lease Notice and No Surface Occupancy Stipulations:

LEASE NOTICE: The lessee shall abide by and conform to the appropriate provisions of Titles 36 Code of Federal Regulations (CFR) Part 228 and 43 CFR 3160 relative to maintenance of casing, environmental obligations, and protection of subsurface water.

NO SURFACE OCCUPANCY STIPULATION: The lessee shall not place well pad or support equipment on existing mine spoil piles. The lessee shall not enter, approach, disturb, inhabit, or investigate any abandoned mines or exploratory excavations.

3.15 ISSUE 12B: HUMAN HEALTH AND SAFETY

3.15.1 HAZARDS ASSOCIATED WITH OIL AND GAS LEASING

The most common radiological problem associated with oil and gas production accompanies the entrainment of produced waters that accompany crude oil brought to the surface. Relatively elevated concentrations of dissolved radium-226 and radium-228 are brought to the surface with the produced waters. Radium precipitates from solution and contaminates production facilities (e.g. pipes, heater-treaters, tank batteries, and brine pits). As oil wells age, the ratio of the quantities of produced waters to the quantity of crude oil increases. Former practices and regulations did not allow for proper controls and, in some cases, led to potentially hazardous conditions. With current controls, those wastes are either re-injected down to their origin or are properly disposed of at permitted waste disposal facilities. Proper occupational controls are required to limit exposure to oil field workers prior to proper disposal.

Naturally occurring radioactive materials are a source of radiation exposure to all humans. Natural activity is present in varying concentration in soil, water, foodstuffs, and air. The radiation exposure is elevated where natural deposits have higher concentrations. Human activities with natural radioactivity can result in enhanced exposure to humans. Uranium mineral deposits, such as those that were mined in the study area, consist of three “families” or series of radionuclides. The Uranium-238 Series predominates and is always accompanied by the Uranium-235 Series. The same geological setting typically includes varying amounts of the Thorium-232 Series. The combination of the three Series includes 37 different isotopes with individual unique properties. Some of these radionuclides are sources of penetrating radiation and can cause external exposure. Some radionuclides are primarily a source of internal exposure following inhalation and ingestion.

Within the Uranium-238 Series, radon-222 is a noble (or inert) gas produced by the decay of radium-226. Radon-222 decays to form particles (solids) of short half-lived radioactive daughters. Radon gas can emanate from radium-226-bearing material. Inhalation of airborne radon-222 daughters (primarily polonium-218 and polonium-214) causes a radiation dose to the bronchial epithelium in the lungs. The Thorium-232 Series similarly includes radon-220 with the same exposure scenario. It usually takes some time for radon to emanate from the containing matrix. Generally, more radon-222 emanates given its radiological “half-life” (the time in which half the atoms of a particular radioactive nuclide disintegrate--the half-life is a characteristic property of each radioactive isotope) of 3.82 days compared to radon-220 with a half-life of 55.6 seconds. In the latter case, more of the radon-220 does not escape because it decays back to a solid and gaseous diffusion ceases. The Uranium-235 Series also contains radon-219; however, uranium-235 is a relatively small fraction of natural uranium compared to uranium-238. In addition, radon-219 has a half-life of only 3.96 seconds.

A commonly observed geochemical separation results in radium being preferentially leached away from other elements within the natural deposits. This is commonly observed with unique concentrations of radium-226 and radium-228 in ground water. In a limited number of environmental settings, lead-210 (with daughters bismuth and polonium-210) has been uniquely present in ground water. Finally, uranium-238 has also been identified in somewhat elevated

concentrations in ground water. Due to its physical and chemical properties, the primary concern with ingestion of uranium-238 is its toxicity (the quality or condition of being poisonous, harmful, or destructive) rather than the attendant radiation dose. However, inhalation of airborne uranium is a radiological concern.

Radon is very soluble in water, but poses relatively little radiation ingestion dose. The most important pathway is the inhalation of daughters from radon that has off-gassed from water. Natural emissions can be remarkably high when ground water reaches the surface (e.g. natural springs in caves and deep-water wells with elevated temperature and pressure).

The nature and extent of the natural background radiation exposure to humans depends upon the location-specific concentrations and the attendant human presence and activities. Activities, including mining and oil and gas production, can concentrate the naturally occurring radioactive materials, enhance the exposure pathways, and lead to elevated radiation dose to individuals present in those locations.

It is noted that natural conditions, exclusive of any human activity, can lead to higher levels of naturally occurring radioactive material. Again, the extent of any increased human radiation exposure depends on the nature of that exposure. Naturally occurring uranium and thorium are present in all rocks and in the associated soils. The typical ranges of concentrations are (NAP 1999):

Uranium-238	0.2 to 1.6 pCi/g
Thorium-232	0.1 to 22 pCi/g

With no geochemical separation, the daughter radionuclides in each series are generally in equilibrium (equal activity concentrations) with the parent of the respective series. Radon concentrations, and those of their respective daughters, can be depleted by emanation of the gas out of the soil and rocks.

Radium-226 (within the Uranium-238 Series) and its decay products constitute most of the internal radiation dose from naturally occurring radionuclides. Radium-226, and its daughters, are sources of external exposure due to gamma radiation (principally lead and bismuth-214). Internal exposure occurs through ingestion (e.g. drinking water) and inhalation. Inhalation includes airborne radium-226 particles and airborne radon-222 daughters. There can be some difference between uranium-238 and radium-226 concentrations due to weathering and soil development processes. Natural surface soil concentrations of radium-226 in the United States range from 0.2 to 4.2 pCi/g. Radium-226 concentrations in surface water ranges from 0.1 to 0.5 pCi/L. Groundwater concentrations are typically higher and may exceed 5 pCi/L. (NAP 1999.)

Radium-228 (within the Thorium-232 Series) and its decay products contribute to a somewhat higher external radiation exposure compared to equal concentrations of radium-226 and its daughters. Internal exposure from radium-228 also occurs through ingestion and inhalation. There is usually no substantial dose due to the inhalation of radon-220 daughters because a much smaller fraction emanates from the matrix.

The ratio of thorium-232 to uranium-238 background concentrations can be expected to be about one to one. However, it is not unusual for thorium-232, and its daughters, to exceed that ratio. Similarly, it is not unusual for groundwater concentrations of radium-228 to be higher than those of radium-226.

Natural airborne radon-222 concentrations vary with non-radiological conditions including temperature and atmospheric pressure. Typical outdoor concentrations range from 0.1 to 0.5 pCi/L. Locations with higher concentrations of naturally occurring radium-226 can average over 1.2 pCi/L. Concentrations of radon-222 in soil pore gas range from 100 to 1,000 pCi/L. (NAP 1999.) The fraction that can emanate from the soil surface depends on the rate of diffusion out of the soil. Elevated temperature and soil disturbance (e.g. digging and blading) will increase the emanating fraction. The extent of atmospheric dispersion and dilution of airborne radon depends on meteorological conditions including wind speed and mixing height. Relative to the latter, a strong temperature inversion reduces the mixing height and can increase radon-222 concentrations as much as a factor of 100.

It takes some time for radon-222 daughters to “grow in” based upon the rate of radon-222 decay. With the 3.8 day half-life, daughter concentrations can be about one-half of the radon-222 concentration within 3.8 days and about three-fourths within 7.6 days. Therefore, the rate of radioactive decay of radon-222 means that several weeks of decay are required to approach equal concentrations of radon-222 and its daughters. However, the latter case is rarely found in airborne concentrations because other mechanisms remove the daughters. Polonium-218 is the first daughter of radon-222 and it has a high electrostatic charge. Much of the polonium-218 is scavenged onto airborne particles. Some of those particles are relatively large and fall to the ground relatively quickly. Polonium-218 will also plate out on any available surfaces and not become airborne. Airborne concentrations of radon daughters will always be depleted compared to the amount produced by the radioactive decay of radon.

Given the typical natural radiological background conditions, the average background whole body equivalent dose rate to the public is roughly 100 mrem/yr. The dose due to the inhalation of radon-222 daughters is roughly 200 mrem/yr. (NAP 1999.)

Control of untoward radiation exposure is motivated by the risk of cancer induction. The assessment of the equivalent dose and risk becomes complex given the factors to be considered in the hazard identification. Each individual radionuclide has varying chemical and physical characteristics that bear upon the consequential dose. In addition, the specific exposure pathways must be considered. For example, elevated concentrations of radium-226 contribute to both external and internal exposure. The internal exposure includes ingestion and inhalation. Inhalation delivers dose through inhalation of airborne particles of radium-226 as well as the inhalation of radon daughters. The affected organs are different with the two different inhalation paths. The affected organs, and the extent of the effect following inhalation and ingestion, depends upon the solubility of the internally deposited material. With the ingestion pathway, dose is minimized with insoluble material. Inhalation of insoluble material elevates the lung dose.

The risk of cancer induction also depends upon the chemical and radiological characteristics of each specific radionuclide, the affected organs, and the susceptibility of each organ to the type(s) of cancer(s) that might be induced.

The complex issues have been evaluated by a number of scientific organizations. The basis for radiation protection standards is research on limited human experience, animal experiments, and on biochemical experiments at the cellular level. The United States contributes to the International Commission on Radiological Protection and the United Nations Scientific Committee on the Effects of Atomic Radiation. Within the United States, the National Council on Radiation Protection and Measurements, and the National Research Council, contribute to domestic standards for radiation protection. The U.S. Environmental Protection Agency and its Science Advisory Board draft laws and regulations to protect members of the public. Other federal agencies must comply with the EPA regulations regarding protection of the public. The U.S. Nuclear Regulatory Commission drafts implementing regulations for nuclear power plants, uranium mills, and all other licensed users of radioactive materials. The U.S. Department of Energy drafts implementing regulations for their facilities.

Regulation and protection for TENORM is uniquely regulated by each state. While not the regulating authority, the U.S. Environmental Protection Agency has sponsored suggested regulations for the control of TENORM. Many states have TENORM regulations in place based upon the EPA suggested regulations. Some have modified the suggested regulations. Other states, including South Dakota, do not have TENORM regulations.

A number of radiation protection limits and guidances have evolved in response to specific issues. As a consequence, the numerical protection values for various parameters are not necessarily equivalent in the degree of protection.

The EPA has proposed a primary dose limit of 100 mrem/yr for chronically exposed members of the public from all controlled sources of exposure. (NAP 1999.) This is the whole body dose equivalent and does not include the dose due to the inhalation of radon daughters. The EPA, therefore, has proposed lower equivalent limits, for other regulations and guidances, so that the cumulative dose rate from the various contributing exposure pathways is not expected to exceed the 100 mrem/yr.

Under the Clean Air Act (40 Part 61), the EPA established an annual limit, from all sources, of 100 mrem/yr (exclusive of radon) for federal facilities. A radon surface emission limit of 20 pCi/m²-sec was established.

Under the Safe Drinking Water Act (40 CFR 141), the EPA established a limit of 5 pCi/L for the sum of radium-226 plus radium-228 in drinking water. A limit of 30 µg/L of uranium in drinking water was established based on toxicity and not the radiation dose.

The EPA Standards for radioactivity in liquid discharges (40 CFR Part 440) established a 30-day average limit of 3 pCi/L of dissolved radium-226, 10 pCi/L total radium-226, and 2 mg/L for uranium. Daily averages are not to exceed 10 pCi/L, 30 pCi/L, and 4 mg/L respectively.

The EPA Standards for operations of the uranium fuel cycle (40 CFR Part 190) established annual dose limits of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ.

Under CERCLA and 40 CFR Part 300, the EPA established a cleanup limit consistent with a risk of 10^{-4} . That is a risk equivalent to one cancer death among 10,000 people exposed at that level. The basis is the cumulative Slope (or risk) Factors assigned to specific radionuclides with distinct exposure pathways and chemical forms.

The EPA established criteria in 40 CFR Part 192 for uranium and thorium mill tailings that include levels that might be considered in relation to TENORM. Relevant criteria are listed in Table 3.15-1.

Table 3.15-1. 40 CFR 192 Standards for Mill Tailings

Constituent	Standard
Radon-222	<ul style="list-style-type: none"> • Annual average release equivalent to 20 pCi/m²-sec • Off-site airborne limit of 0.5 pCi/L • Indoor radon, including background, of 0.03 • Working Levels with an objective of 0.02
Gamma Radiation	<ul style="list-style-type: none"> • Indoor gamma radiation of 20 μR/hr above background.
Radium and Uranium	<ul style="list-style-type: none"> • An average concentration (100 m² area) of 5 pCi/g radium-226 in the top 15 cm of soil and 15 pCi/g below 15 cm • The sum of 5 pCi/L of radium-226 plus radium-228 and a sum of 30 pCi/L of uranium-238 plus uranium-234 in ground water

3.16 ISSUE 13: NATIONAL NATURAL LANDMARKS

3.16.1 AFFECTED ENVIRONMENT

3.16.1.1 Definition and Purpose

A National Natural Landmark (NNL) is a nationally significant natural area that has been designated by the Secretary of the Interior. To be nationally significant, a site must be one of the best examples of a type of biotic community or geologic feature in its physiographic province. Such examples include terrestrial and aquatic ecosystems; geologic features, exposures, and landforms that record active geologic processes or portions of earth history; and fossil evidence of biological evolution. It is a goal of the program to identify, recognize, and encourage the protection of sites containing the best remaining examples of ecological and geological components of the nation's landscape. Landmarks are designated on both public and private land, with the program designed to have the concurrence of the owner or administrator. To date, 587 sites have been designated as National Natural Landmarks.

3.16.1.2 Legislative and Administrative History

The program was established by the Secretary of the Interior in 1962, under authority of the Historic Sites Act of 1935 (16 U.S.C. 461-467), and administered by the National Park Service. The revised National Natural Landmark Program Regulations, 36 CFR Part 62, were published in the Federal Register on May 12, 1999.

3.16.1.3 National Natural Landmarks Specific to the Sioux Ranger District

The Castles National Natural Landmark (the Castles NNL) was designated by the Secretary of the Interior and was added to the National Register of Natural Landmarks in 1976 (National Park Service 1999). It is 1,005 acres in size and is located in the northern part of the Slim Buttes (EPA n.d.). It is one of 13 NNLs in the State of South Dakota, and was designated based on its scenic beauty, spectacular erosion forms, exposed stratigraphy, and its fossil record. The Castles NNL is one of two NNLs within the Custer National Forest. Both of these NNLs are on the Sioux Ranger District. The other is Capitol Rock NNL located in the Long Pines land unit in Montana. Management Area (MA) O in the Forest Plan covers these two NNLs (USFS 1987, p. 86). The stated Management Area O goal of the NNL designation is to protect the unique geological and scenic features of the National Natural Landmarks and provide recreation opportunity. The National Natural Landmark status does not withdraw these areas from mineral entry; however, Forest Plan Amendment No. 1 only allows leasing with no surface occupancy (USFS 1987, p. 86) in MA O.

The Castles NNL is bounded by State Lands (Forest Boundary) to the east and private holdings to the west. The northern boundary extends beyond Highway 20 and is bounded by Management Area B (range), as is the southern boundary. The northern boundary is also shared with Management Area F (developed recreation) which, like Management Area O, mandates a No Surface Occupancy lease stipulation for oil and gas leasing activities within all developed recreation sites. MA F stipulates timing limitations within one-quarter mile of developed sites.

The allocated Management Areas (MAs) and prescribed standards relevant to oil and gas leasing within the Slim Buttes land unit that apply in and around the Castles NNL are outlined in Table 3.16-1.

Table 3.16-1. Management Areas in the Slim Buttes Land Unit within or Adjacent to the Castles NNL

Management Area	Acres	Prescribed Management Standards
B – Range	NA	<ul style="list-style-type: none"> • Semi-Primitive and Roaded Natural recreation opportunities will be provided. • VQOs will include Retention, Partial Retention, and Modification. Management activities will be designed to blend with the natural landscape. The VQO as assigned to the areas or as determined through the environmental analysis will be met by the development activities, subject to valid existing rights.
F – Developed Recreation	119	<ul style="list-style-type: none"> • The recreation setting will vary among the developed sites from Semi-Primitive, Motorized, Roaded-Natural, and Rural. Sites will be characterized by predominantly natural or natural-appearing environments to a substantially modified natural environment. <p>Oil and Gas Development</p> <ul style="list-style-type: none"> • Mitigation measures may include actions such as timing, seasonal, or location restrictions. Design of features will meet Visual Quality Objectives. • A No Surface Occupancy lease stipulation will be applied to all developed recreation sites. • A Surface Occupancy Restriction (timing) stipulation will be applied to all new oil and gas leases within one-quarter mile of developed sites from May 15 to September 15.
O – National Natural Landmark	849	<ul style="list-style-type: none"> • The recreation setting will be Roaded Natural (also see Recreation Issues section). • Road and interpretive signing will be used to inform the public about the Castles National Natural Landmark. • If oil and gas development activities are proposed in this Management Area, the intent will be to protect the unique geologic and scenic features. • A No Surface Occupancy stipulation will be added to any new lease. • The Visual Quality Objective (VQO) is Retention. The landscape may be modified to facilitate public use and enjoyment of the area (also see Scenic Resources Section).

The Roaded Natural recreation setting is defined as a classification where timber harvest or other surface practices are evident. Motorized vehicles are permitted on all or parts of the road system.

The VQO for Retention is described as areas in which changes in the landscape are not visually evident to the average person unless pointed out. They appear to be unnoticed alterations.

3.16.2 ENVIRONMENTAL CONSEQUENCES

3.16.2.1 Alternative 1 - No Action, No New Leases

Direct, Indirect, and Cumulative Effects

Under Alternative 1, no new leasing would occur. Only the existing leases in the North and South Cave Hills land units would be subject to any oil and gas activities. Since the North and South Cave Hills land units are over 20 miles distant from the Castles NNL in the Slim Buttes land unit, no direct, indirect or added cumulative effects to the Castles NNL would occur.

3.16.2.2 Alternative 2 - Lease with Forest Plan Stipulations

Alternative 2 would allow the Castles NNL area to be included in new oil and gas leases as part of the Slim Buttes land unit; however, all of the National Forest System land in the Castles NNL would be under an NSO stipulation. Wells could be directionally drilled into the subsurface area from private lands but this is unlikely based on topography and the RFD forecasts.

Direct Effects

A No Surface Occupancy (NSO) stipulation for the Castles NNL would be included in any new lease. Consequently, no direct effects would be expected.

Indirect Effects

Oil and gas activities in the areas around the Castles NNL could affect both the scenic views from the NNL and the recreational experience. The subsurface oil and gas resources under the NNL would be leased under this alternative. It is possible these subsurface resources could be reached by directional drilling from outside the NNL. Examination of the Alternative 2 Composite Stipulations map, Figure 2.09, shows that adjacent National Forest System lands are also designated no surface occupancy. However, directional drilling could occur on State or private lands to the east and west of the NNL.

The nearest projected RFD well would be located approximately two miles to the north of Castles NNL. Oil and gas leasing activities such as exploration, development, and production would not be visible from the NNL. Some low level temporary disruptions to visitors due to increased traffic might occur during exploration and well construction if oil and gas leasing were approved. VQOs for the MAs adjacent to the Castles would be met. The two other wells projected for the Slim Buttes land unit would be located over 10 miles away from the Castles and would not be visible or hamper visitation to this point of interest. All of the RFD wells projected for the Slim Buttes are expected to be dry wells; therefore, the impacts would be short-term only.

The RFD is a hypothetical projection of the number and location of wells and roads for analysis purposes. A lessee is not obligated to follow the RFD. As a consequence, oil and gas activities could be located on State or private lands that could impact the Castles NNL. However, given the low number of wells projected in the Slim Buttes land unit and the fact that they are all projected to be dry wells, the likelihood of oil and gas activities on these adjacent private lands is considered low. If such development did occur, the indirect impact on the Castles NNL is expected to be at a very low level due to the intervening terrain.

Cumulative Effects

The cumulative impact of other past and present projects on the Castles NNL is insubstantial. Given that the RFD projects only three wells in the Slim Buttes, with all of them distant from the NNL and all of them projected to be dry wells, the cumulative effect considering this alternative and other future projects is expected to remain insubstantial.

3.16.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

Alternative 3 would allow the Castles NNL area to be included in new oil and gas leases as part of the Slim Buttes land unit; however, all of the Slim Buttes would be classified as No Surface Occupancy (NSO). Wells could be directionally drilled into the subsurface area from State or private lands but this is unlikely based on topography and the RFD forecasts for dry wells.

Direct Effects

A No Surface Occupancy (NSO) stipulation for the Castles NNL and the Slim Buttes land unit would be included in any new lease under Alternative 3. Consequently, no direct effects would be expected.

Indirect Effects

Oil and gas activities in the areas around the Castles NNL could affect both the scenic views from the NNL and the recreational experience. The subsurface oil and gas resources under the NNL would be leased under this alternative. It is possible these subsurface resources could be reached by directional drilling from outside the NNL or the Slim Buttes land unit. Examination of the Alternative 3 Composite Stipulations map, Figure 2.23, shows that adjacent National Forest System lands are designated with either NSO, CSU or TL stipulations. Directional drilling could occur on Forest lands with CSU and TL stipulations or on private lands to the east and west of the NNL.

The nearest projected RFD well would be located approximately three miles to the north of the Castles NNL. Oil and gas leasing activities such as exploration, development, and production would not be visible from the NNL. Some low level temporary disruptions to visitors due to increased traffic might occur during exploration and well construction if oil and gas leasing were approved. VQOs for the MAs adjacent to the Castles would be met. The two other wells projected for Slim Buttes would be located over 10 miles away from the Castles and would not be visible or hamper visitation to this point of interest. All of the RFD wells projected for Slim Buttes are expected to be dry wells; therefore, the impacts would be short-term only.

The RFD is a hypothetical projection of the number and location of wells and roads for analysis purposes. A lessee is not obligated to follow the RFD. As a consequence, oil and gas activities could be located on State or private lands that could impact the Castle NNL. However, given the NSO status for the Slim Buttes and the fact that all the wells are projected to be dry wells, the likelihood of oil and gas activities on these adjacent private lands is considered low. If such development did occur, the indirect impact on Castles NNL is expected to be at a very low level due to the intervening terrain.

Cumulative Effects

The cumulative impact of other past and present projects on Castles NNL is insubstantial. Given that the RFD projects only three wells in Slim Buttes that would not be located on NFS land, and the projection that directionally drilled wells would be dry, the cumulative effect considering this alternative and other future projects is expected to remain insubstantial.

3.17 ISSUE 14: RESEARCH NATURAL AREAS

A portion of Deer Draw in the Slim Buttes land unit has been proposed as a Research Natural Area (RNA). The proposed RNA contains 2287.5 acres. There is concern that proposed oil and gas activities may alter the ecological processes that make Deer Draw an important RNA opportunity.

3.17.1 AFFECTED ENVIRONMENT

Deer Draw features vegetation types that are absent from other designated natural areas within the region. Of primary importance is the presence of an interconnected series of woody draws in good to excellent ecological condition.

Existing and candidate RNAs are addressed under Management Area L in the Custer Forest Plan (USFS 1987, p. 77-78). Proposed RNAs are managed as RNAs until classified. The management goal is to provide an opportunity for research, study, observation, and monitoring of naturally occurring ecological processes. RNAs are protected against activities that directly or indirectly modify ecological processes. RNA landscapes essentially possess the visual characteristics of a natural condition. The Visual Quality Objective is preservation.

3.17.2 ENVIRONMENTAL CONSEQUENCES

3.17.2.1 Alternative 1 – No Action, No New Leases

Direct, Indirect, and Cumulative Effects

There would be no direct, indirect, or added cumulative effects to the proposed Deer Draw RNA if Alternative 1 were implemented. Oil and gas activities would only occur in existing lease areas under Alternative 1. There are no existing leases within the Slim Buttes land unit within which the proposed Deer Draw RNA exists. Existing leases only occur within the North and South Cave Hills land units, which are too distant to cause any direct, indirect, or added cumulative effects to the ecological processes within the proposed Deer Draw RNA.

3.17.2.2 Alternative 2 - Lease with Forest Plan Stipulations

Alternative 2 would allow the proposed Deer Draw RNA to be included in new oil and gas leases as part of the Slim Buttes unit.

Direct Effects

The Custer Forest Plan requires that a No Surface Occupancy (NSO) stipulation be implemented for any oil and gas leases that would be located in RNAs (USFS 1987, p. 79). The Forest Plan directs that proposed RNAs be managed as RNAs until classified (USFS 1987, p. 78). As a result, there would be no pads or wells allowed in the proposed Deer Draw RNA. Furthermore, no new road construction is allowed in a proposed RNA under Forest Plan direction (USFS 1987, p. 79). Only existing public roads within the proposed RNA could be utilized. Consequently, there would be no direct effects.

Indirect Effects

Oil and gas activities in the areas around the proposed Deer Draw RNA could indirectly affect ecological processes within the proposed Deer Draw RNA. Typical indirect biological/ecological effects are described in DEIS Section 3.1 Biodiversity. The subsurface oil and gas resources under the Deer Draw RNA would be leased under this alternative. It is possible these subsurface resources could be reached by directional drilling from areas adjacent to the proposed Deer Draw RNA. This could put oil and gas activities adjacent to the proposed Deer Draw RNA boundary. In addition, the area adjacent to and surrounding the proposed RNA could have oil and gas activities related to subsurface resources there.

The Alternative 2 biological stipulations presented in Chapter 2, discussed in Section 3.1 Biodiversity, and shown on Figure 2.19 in the accompanying map packet, will prevent or condition oil and gas activities on the surrounding lands in a manner that will mitigate potential indirect impacts to the proposed RNA.

The three proposed RFD wells in Slim Buttes are hypothetically located approximately 1, 2, and over 10 miles to the north of the proposed Deer Draw RNA. All of the RFD wells projected for Slim Buttes are expected to be dry wells. Therefore, according to the RFD, any impacts would be short-term only. The RFD is a hypothetical projection of the number and location of wells and roads for analysis purposes. A lessee is not obligated to follow the RFD. As a consequence, oil and gas activities could be located within close proximity to the proposed Deer Draw RNA. However, given the low number of wells projected in Slim Buttes and the fact that they are all projected to be dry wells, the likelihood of oil and gas activities on these adjacent lands is considered low. If such development did occur, the indirect effects to the ecological processes in the proposed Deer Draw RNA are expected to be at a low level and insubstantial given the biological and other Alternative 2 lease stipulations that would apply.

Cumulative Effects

The cumulative impact of other past and present projects on the proposed Deer Draw RNA is insubstantial. Given that the RFD projects only three wells in Slim Buttes, with all of them distant from the proposed Deer Draw RNA and all of them projected to be dry wells, the cumulative effect considering this alternative and other future projects is expected to remain insubstantial.

3.17.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

In the Alternative 3 leasing scenario, all of the Slim Buttes land unit is under the NSO stipulation for cultural resources considerations. Two of the RFD projected wells are eliminated and of the other two, one is projected more than 10 miles to the north on a private in-holding and the other is several miles south of the proposed RNA off the Forest. Furthermore, both wells are projected to be dry gas wells that would be abandoned and reclaimed. As a result, there are no projected direct, indirect, or cumulative impacts to the proposed RNA assuming Alternative 3 were implemented.

3.18 ISSUE 15: PUBLIC ACCESS

This analysis incorporates by reference the Forest Roads Analysis signed January 2003 by Forest Supervisor Nancy Curriden.

3.18.1 AFFECTED ENVIRONMENT

Primary uses of the National Forest road system include recreation visits (scenic driving, hunting, camping, picnicking, etc.), National Forest administration, and other National Forest uses (grazing, oil production, mineral exploration). The Sioux Ranger District is located in a remote area away from major transportation corridors; therefore, traffic is typically light.

3.18.1.1 Access and Traffic

A network of Interstates, state highways, and county roads provides access into and around Sioux Ranger District. This network is extended by approximately 184 miles of National Forest System Roads. Right-of-way is lacking on certain roads, thus closing those areas to public.

The existing transportation system of county roads and state highways around the Forest are outside the scope of this study. The Forest Service has not designated any roads exclusively for off-highway vehicle (OHV) use.

3.18.1.2 National Forest System Roads (NFSRs)

National Forest System Roads (NFSRs) differ from Public Roads in that use is subject to control by the Forest Service. Use of NFSRs is a “permitted” use whereas use of a public road is a right of the public. Funds appropriated by Congress pay for maintenance and construction of NFSR roads; funds derived from state and federal gasoline taxes pay for the maintenance and construction of public roads.

A Commercial Road Use Permit is necessary for commercial use of NFSRs. Commercial users are currently required to pay for or perform their commensurate share of maintenance as well as repair any damage to the road that they may cause. Any requirements deemed necessary to protect the road and adjacent resources or provide for user safety can be stipulated in the permit. Additional roads on federal lands, which would not be on the NFSR system and would not be on leased acres, may be constructed/reconstructed through issuance of a special use permit. The special use permit can contain the same stipulations as a Commercial Road Use Permit. Other than this, the permittee has total responsibility for maintenance and operation of the special use road, including limiting use.

Some oil and gas roads are not physically closed to the general public and are classed as local roads. Local roads that provide access to the individual well sites are managed under the field development plan.

3.18.1.3 Forest Plan Management Direction

Current Forest Plan transportation management direction calls for maintenance of existing roads for administrative and public use of the Forest consistent with resource protection (USFS 1987a, pp. 36-37). Commercial users are required to pay a commensurate share for road maintenance.

Forest Plan management direction calls for:

- *Local roads constructed for a single resource purpose will be closed to public use and obliterated and rehabilitated at the end of their use period.*
- *Forest System roads that have been upgraded or are proposed for upgrading from primitive to commercial standard for the primary purpose of oil development will not necessarily be retained or maintained at commercial standard subsequent to decline or cessation of oil activity.*
- *Traffic management will be considered as an alternative to building double-lane roads. (USFS 1987a, pp. 36-37.)*

The roads of the transportation system directly or indirectly affect most surface resources. Most road improvements result from the need by Forest management for resource development and/or administration of resources. In planning for the development of oil and gas, a roadway would be used for transportation, to accommodate overland and/or underground pipelines, and for communication facilities.

3.18.1.4 Forest Service Designated Traffic Service Levels (TSL)

Traffic service levels (TSL) describe a road's traffic characteristics and operating conditions. These levels are identified as a result of transportation planning activities. Traffic service levels include the traffic characteristics that are important in the selection of design criteria and describe the operating conditions for the road. National Forest Traffic Service Levels are listed in Table 3.18-1 (USFS 1991).

3.18.1.5 Affected Environment by Unit

National Forest System Roads within the Sioux Ranger District are generally one-lane roads with turnouts for two-way passage (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002). Currently, traffic on these roads is generally operating at Service Level C. During peak times of the year at developed recreation sites, traffic flow could be reduced to Service Level D. During occasional road maintenance or construction, Service Levels could drop to D but this would be temporary. Visitor levels to the Forest are low: 8,800 Recreation Visitor Days (RVDs) in 1995 (USFS 1995). Only 1,000 of these RVDs were for automobile travel. (See Tables 3.7-1 and 3.8-1 in Dispersed Recreation and Developed Recreation, respectively.)

Table 3.18-1. Forest Service Traffic Service Levels

Traffic Factor	A	B	C	D
Flow	Free flowing with adequate parking facilities	Congested during heavy traffic such as during peak logging or recreation	Interrupted by limited passing facilities, or slowed by the road condition	Flow is slow or may be blocked by an activity. Two-way traffic is difficult and may require backing to pass.
Volumes	Uncontrolled; will accommodate the expected traffic	Occasionally controlled during heavy use periods	Erratic; frequently controlled as the capacity is reached	Intermittent and usually controlled. Volume is limited to that associated with the single purpose.
Vehicle Types	Mixed; includes the critical vehicle and all vehicles normally found on public roads	Mixed; includes the critical vehicle and all vehicles normally found on public roads	Controlled mix; accommodates all vehicle types including the critical vehicle. Some use may be controlled to vehicle types	Single use; not designed for mixed traffic. Some vehicles may not be able to negotiate. Concurrent use traffic is restricted
Critical Vehicle	Clearances are adequate to allow free travel. Overload permits are required	Traffic controls needed where clearances are marginal. Overload Permits are required	Special provisions may be needed. Some vehicles will have difficulty negotiating some segments	Some vehicles may not be able to negotiate. Loads may have to be off-loaded and walked in.
Safety	Safety features are a part of the design	High priority in design. Some protection is accomplished by traffic management	Most protection is provided by management	The need for protection is minimized by low speeds and strict traffic controls.
Traffic Management	Normally limited to regulatory, warning, and guide signs and permits	Employed to reduce traffic volumes and conflicts	Traffic controls are frequently needed during periods of high use by the dominant resource activity	Used to discourage or prohibit traffic other than that associated with the single purpose.
User Costs	Minimize; transportation efficiency is important	Generally higher than "A" because of slower speeds and increased delays	Not important; efficiency of travel may be traded for lower construction cost	Not considered

Table 3.18-1. Forest Service Traffic Service Levels (Cont'd)

Traffic Factor	A	B	C	D
Alignment	Design speeds is the predominant factor within feasible limitations	Influenced more strongly by topography than by speed and efficiency	Generally dictated by topographic features and environmental factors. Design speeds are generally low	Dictated by topography, environmental factors, and the design and critical vehicle limitations. Speed is not important.
Road Surface	Stable and smooth with little or no dust, considering the normal season of use	Stable for the predominant traffic for the normal use season. Periodic dust control for heavy use or environmental reasons. Smoothness is commensurate with the design speed	May not be stable under all traffic or weather conditions during the normal use season. Surface rutting, roughness, and dust may be present, but controlled for environmental or investment protection	Rough and irregular. Travel with low clearance vehicle is difficult. Stable during dry conditions. Rutting and dusting controlled only for soil and water protection

Source: USFS 1987b.

North Cave Hills

There are currently 45 miles of National Forest System Roads within the North Cave Hills unit. These roads are currently operating at Service Level C. Most of these roads are located within Management Area E (minerals management). The Custer National Forest Management Plan for MA Mineral Management states as follows:

Road construction will be primarily for the development of oil and gas resources and locatable minerals. Roads will not be constructed on slopes of 40% or greater. Exceptions may be made for short distances, i.e. one-quarter mile or less where this will minimize the total impacts to the area. (USFS 1997 p. 60.)

South Cave Hills

There are currently 29 miles of National Forest System Roads within the South Cave Hills unit. These roads are currently operating at Service Level C. Most of these roads are located within Management Area B (range). The Custer National Forest Management Plan for MA B states as follows:

Oil and gas development within this management area could occur in scattered areas resulting in approximately one to two miles of road per square mile on initial entry and up to six miles per square mile with secondary and tertiary recovery within the activity area. (USFS 1987a, p 47.)

Slim Buttes

There are currently 93 miles of National Forest System Roads and 4.95 miles of Highway within the Slim Buttes unit. The Highway provides access to Reva Gap and the Castles National Natural Landmark. The NFSRs are currently operating at Service Level C. Most of these roads are located within MA B Range. The Custer National Forest Management Plan for MA B states as follows:

Oil and gas development within this management area could occur in scattered areas resulting in approximately one to two miles of road per square mile on initial entry and up to six miles per square mile with secondary and tertiary recovery within the activity area. (USFS 1987a, p. 47.)

West Short Pines

There are currently four miles of National Forest System Roads within the West Short Pines unit. These roads are currently operating at Service Level C. Most of these roads are located within Management Area D (wildlife/fish). The Custer National Forest Management Plan for MA D states as follows:

Access roads needed to meet legal obligations will be provided as required, but roads will be routed to minimize loss of wildlife habitat. Roads will not be constructed on slopes of 40% or greater. Exceptions may be made for short distances, i.e. one-quarter mile or less where this will minimize the total impacts to the area. (USFS 1987a, p. 56.)

East Short Pines

There are currently 12 miles of National Forest System Roads within the East Short Pines unit. These roads are currently operating at Service Level C. Most of these roads are located within Management Area D (wildlife/fish). The Custer National Forest Management Plan for MA D states as follows:

Access roads needed to meet legal obligations will be provided as required, but roads will be routed to minimize loss of wildlife habitat. Roads will not be constructed on slopes of 40% or greater. Exceptions may be made for short distances, i.e. one-quarter mile or less where this will minimize the total impacts to the area. (USFS 1987, p. 56.)

Surrounding Area

The surrounding area is outside the scope of this study.

3.18.2 ENVIRONMENTAL CONSEQUENCES

This section focuses on the amount of additional traffic that could be generated for each alternative for each unit and whether the resultant traffic could result in a substantial impact.

Construction and use of roads and highways can have direct and indirect effects. Effects from road construction and use on other resources are discussed in other sections of this chapter where applicable. The existing road network is shown on maps in Chapter 2.

Table 3.18-2 demonstrates the typical number of truck and car trips expected for construction and maintenance of a single well. One to three wells could be constructed at one time (to be determined at time of permitting).

Table 3.18-2. Number of Truck and Car Trips per Well

Activity	Duration	Truck Trips Per Day	Equipment Operation	Car Trips per day (2 Workers per Car, to and from site)
Road Building	3-5 days per mile ¹	6 Truck Trips total (to haul equipment in-day 1 and out-day 3, 4, or 5)	3 (1 grader, 1 scraper, 1 dozer)	1.5
Drilling	10-15 days for a straight drill, 25-30 days for a horizontal drill	1 water truck ² 3 Pipe Truck Trips	1 Drill Rig	12
Well Construction	3-6 days	Average 3 (Concrete, Equipment Haul, Pump Unit and Tank Batteries Haul)	2 (dozer & boom)	12
Maintenance	Lease	1 Pumper. If repair is needed, add 1 Water Truck and 1 Semi	0	0

¹ Depends on terrain, how much cut and fill.
² Multiple trips could be made if large volumes of water are needed during drilling.
Source: Don Haenfler, Continental Oil Company, September 2002.

3.18.2.1 Alternative 1 - No Action, No New Leases Alternative

Any roads that would be used for additional wells under existing leases would be maintained by the oil company utilizing those roads. Any roads that are not up to the standard required for truck use would be improved by the oil company. Traffic controls would be maintained by the oil company as required by the Manual on Uniform Traffic Control Devices (MUTCD). A Road Use Agreement or a Commercial Road Use Permit would be required by the Forest Service for oil company use of National Forest System Roads.

North Cave Hills

Under the No Action Alternative, approximately 0.3 mile of new road could be built to construct and maintain two separate well facilities within existing lease areas representing an increase in road mileage of less than one percent within the North Cave Hills unit. As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public, and although this would represent a short-term irretrievable effect, it would not be substantial. An irretrievable impact is one that is sustained for a certain period of time but is reversible. These roads would be decommissioned at the end of the life of the project and rehabilitated to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity could result in approximately 28 truck trips to the two projected well locations for 16 to 42 days each. Approximately 20 car trips by workers could be expected over the same period. Access to portions of the Forest could have more traffic than usually expected if a Forest visitor attempts travel on a NFS Road at the same time as truck trips or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. This could represent a brief irretrievable inconvenience to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck could be expected to visit both new sites and the two existing sites once per day. See Table 3.18-3. These vehicle trips would not be expected to lower the current Traffic Service Level. Public access to National Forest System lands would not be expected to change irreversibly under the No Action Alternative due to this number of truck trips.

Table 3.18-3. Public Access to North Cave Hills under the No Action Alternative

Duration	Estimated Truck Trips Per Day	Estimated Car Trips Per Day
Construction Activity 16 to 42 days at 2 locations	28 total (14 per day on average at 2 locations)	20 total (10 on average at 2 locations)
Maintenance Activity	10 total trips (1 pumper truck per day at 5 locations: 3 existing and 2 projected wells)	None

South Cave Hills

Under the No Action Alternative, approximately 0.4 mile of new road could be built to construct and maintain three separate well facilities within existing lease areas, representing an increase in road mileage of less than one percent within the South Cave Hills unit. As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this land area would represent a short-term irretrievable impact, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity could result in a total of approximately 42 truck trips to the three projected well locations for 16 to 42 days each. Approximately 30 car trips by workers could be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS Road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck could be expected to visit the three new sites and one existing site once per day. These vehicle trips would not be expected to lower the current Traffic Service Level. See Table 3.18-4. Public access to National Forest System lands would not be expected to change dramatically under Alternative 2 due to this number of vehicle trips. Vehicle trips would be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under the No Action Alternative.

Table 3.18-4. Public Access to the South Cave Hills under the No Action Alternative

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days at 2 locations	42 total (14 per day on average at 3 locations)	30 total (10 on average at 3 locations)
Maintenance Activity	8 total trips (1 pumper truck per day at 4 locations: 1 existing and 3 projected wells)	None

Slim Buttes, West Short Pines, and East Short Pines

Under the No Action Alternative, no new roads would be built since there are no existing lease areas within these units. Therefore, no long-term change in TSL, direct, indirect, irreversible, irretrievable, short-term, long-term, or cumulative effects on public access would be expected under the No Action Alternative.

Direct Effects

Under the No Action Alternative, five new wells could be constructed. Spur roads to well sites would be closed to public traffic. Access to portions of the Forest could be inhibited in those five locations if a Forest visitor attempts travel on a NFS Road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term (two to six months), direct irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

Indirect Effects

No indirect effects would be expected under the No Action Alternative.

Irreversible Effects

No irreversible effects would be expected under the No Action Alternative.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Harding County has just completed the Cave Hills road improvement project. No other projects by the County are planned within the Oil and Gas Leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the amount of activity on state lands that would require permits through their office but not many are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects would be expected as a result of these projects.

The State Land commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users regarding this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214

- Continued grazing

The BLM expects approximately 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from the No Action Alternative in addition to these existing activities.

3.18.2.2 Alternative 2 - Lease with Forest Plan Stipulations

Any roads that would be used for additional wells under new or existing leases would be maintained by the oil company utilizing those roads. Spur roads to well sites would be closed to public traffic. Any NFS roads that are not up to the standard required for truck use would be improved by the oil company. Traffic controls would be maintained by the oil company as required by the Manual Uniform Traffic Control Devices (MUTCD). A Road Use Agreement or a Commercial Road Use Permit would be required by the Forest Service for oil company use of National Forest System Roads. Some roads may be located off-Forest. These roads would not be subject to NFS lease stipulations.

This alternative assumes a combination of the Forest Plan oil & gas stipulations and the oil and gas development projections from the RFD (USFS 1987a, page 56).

North Cave Hills

Under Alternative 2, approximately 1.8 miles of road, representing an approximate increase of 3.9 percent, could be built to construct and maintain 12 new wells within the North Cave Hills unit. See Table 3.18-5. As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this would represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity could result in a total of approximately 336 truck trips to the 12 projected well locations for 16 to 42 days each. See Table 3.18-6. Approximately 120 car trips by workers could be expected over the same period of time. Access to portions of the Forest could have more traffic than usually expected if a Forest visitor attempts travel on a NFS Road at the same time as truck trips or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. This could represent a brief irretrievable inconvenience to public access. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck could be expected to visit the three new sites and the two existing sites once per day. These vehicle trips would not be expected to lower the current Traffic Service Level below a TSL D and it would be for a short duration, approximately one

Table 3.18-5. Miles of Projected Roads¹, Truck, and Car Trips within each Land Unit under Alternative 2

Unit	Acres	Number of Projected New Wells	Miles of Existing NFRs	Projected Miles of Road	% Increase in Miles of Roads	Number of Truck Trips ²		Number of Car Trips ²	
						Construction	Maintenance	Construction	Maintenance
North Cave Hills	14,547	12	45.1	1.8	3.9%	336	30	120	0
South Cave Hills	8,876	10	29.2	2.6	8.9%	126	20	90	0
Slim Buttes	46,972	3	93.3	0.3	Less than 1%	56	8	40	0
West Short Pines	1,263	2	3.5	0.3	8.4%	28	8	20	0
East Short Pines	6,147	1	12.4	0.1	Less than 1%	14	2	10	0
Total	77,805	28	183.7	5.1	3.8%	560	68	280	0

¹ Projected miles of roads are based on scenarios provided by the RFD. For purposes of Air Quality Analysis, slightly higher numbers were used (4.28 acres per well road, 3.5 acres per well pad) in order to capture the greatest potential impact to air quality.

² Total during construction period.

month. Maintenance trips could be made by the same truck to most of the locations and would not create a long-term drop in TSL. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 2. Public access to National Forest System lands would not be expected to change dramatically under Alternative 2 due to this number of vehicle trips. Vehicle trips could be spread over time and distance. Although there would be a discernable change that might irritate some people it would not cause traffic congestion or limit access by the public.

Table 3.18-6. Public Access to North Cave Hills under Alternative 2

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	336 total (14 per day on average at 12 locations)	120 total (10 on average at 12 locations)
Maintenance Activity	30 total trips (1 pumper truck per day to and from 15 locations, 3 existing, 12 projected wells)	None

South Cave Hills

Under Alternative 2, 2.6 miles of road, representing an approximate increase of 8.9 percent, could be built to construct and maintain 10 new wells within the South Cave Hills unit. See Table 3.18-5. As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this could represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan (USFS 1987a, pages 36-37) guidelines.

Construction activity could result in a total of approximately 126 truck trips to the 10 projected well locations for 16 to 42 days each. See Table 3.18-7. Approximately 90 car trips by workers could be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck could be expected to visit the 10 new sites and the 1 existing site once per day. These vehicle trips would not be expected to lower the current Traffic Service Level below a TSL D and it would be for a short duration, approximately one month. Maintenance trips could be made by the one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 2 due to this number of vehicle trips. Vehicle trips could be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct,

indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 2.

Table 3.18-7. Public Access to the South Cave Hills under Alternative 2

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	140 total (14 per day on average at 10 locations)	100 total (10 on average at 10 locations)
Maintenance Activity	20 total trips (1 pumper truck per day to and from 10 locations)	None

Slim Buttes

Under Alternative 2, approximately 0.3 mile of new road could be built to construct and maintain three new wells within the Slim Buttes unit, representing less than a one percent increase (see Table 3.18-5). As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this could represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity could result in a total of approximately 56 truck trips to the three projected well locations for 16 to 42 days each. See Table 3.18-8. Approximately 40 car trips by workers could be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck could be expected to visit the three new sites once per day. These vehicle trips would not be expected to lower the current Traffic Service Level and it would be for a short duration, approximately one month. Maintenance trips could be made by the one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 2 due to this number of vehicle trips. Vehicle trips would be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 2.

Table 3.18-8. Public Access to Slim Buttes under Alternative 2

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	42 total (14 per day on average at 3 locations)	30 total (10 on average at 3 locations)
Maintenance Activity	6 total trips (1 pumper truck per day to and from 3 projected wells)	None

West Short Pines

Under Alternative 2, 0.3 mile of new road could be built to construct and maintain two new wells within the West Short Pines unit. This would represent an 8.4 percent increase in road miles within the West Short Pines Unit (see Table 3.18-5). As stated in the Forest Plan (USFS 1987a, pages 36-37) these roads would not be open to the public and although this could represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity could result in a total of approximately 28 truck trips to the two projected well locations for 16 to 42 days each. See Table 3.18-9. Approximately 20 car trips by workers could be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck could be expected to visit the two new sites once per day. These vehicle trips would not be expected to lower the current Traffic Service Level and it would be for a short duration, approximately one month. Maintenance trips could be made by the one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 2 due to this number of vehicle trips. Vehicle trips could be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 2.

Table 3.18-9. Public Access to West Short Pines under Alternative 2

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	28 total (14 per day on average at 2 locations)	20 total (10 on average at 2 locations)
Maintenance Activity	4 total trips (1 pumper truck per day to and from 2 projected wells)	0

East Short Pines

Under Alternative 2, 0.1 mile of new road could be built to construct and maintain one new well within the East Short Pines unit. This change in road miles would represent less than a one percent increase within this unit. See Table 3.18-5. As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this could represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity could result in a total of approximately 14 truck trips to the one projected well location for 16 to 42 days each. See Table 3.18-10. Approximately 10 car trips by workers could be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002

During maintenance activity, one truck could be expected to visit the one new site once per day. These vehicle trips would not be expected to lower the current Traffic Service Level and it would be for a short duration, approximately one month. Maintenance trips could be made by one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 2 due to this number of vehicle trips. Vehicle trips could be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 2.

Table 3.18-10. Public Access to East Short Pines Unit under Alternative 2

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	14 total (14 per day on average at 1 location)	10 total (10 on average at 1 location)
Maintenance Activity	2 total trips (1 pumper truck per day to and from 1 projected well location.)	None

Direct Effects

Under Alternative 2, 28 new wells could be constructed. Access to portions of the Forest could be inhibited in those 28 locations if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other

Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term (10 to 28 months), direct irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

Indirect Effects

No indirect effects to Public Access would be expected under the Alternative 2.

Irreversible Effects

No irreversible effects would be expected under Alternative 2.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include effects of oil and gas leasing activities as well as other activities that are expected to affect access by the public to Forest Lands.

Harding County has just completed the Cave Hills road improvement project. No other projects by the county are planned within the Oil and Gas Leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the amount of activity on state lands that would require permits through their office but not many are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects would be expected as a result of these projects.

The State Land commissioner held an auction October 25, 2002 to sell leases for surface mineral rights in Harding County at 16 sites totaling 6,308 acres.

The Forest Service will continue with the following projects:

- Installation of hazard signs in the North Cave Hills next to uranium mining spoils that have high radiation levels and contain other hazardous materials. A letter was mailed out to Forest Service users regarding this project on August 28, 2002.
- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from Alternative 2 in addition to these existing activities.

3.18.2.3 Alternative 3 – Lease with Additional Stipulations to Protect Forest Resources (Preferred Alternative)

As projected, this alternative would entail a smaller oil and gas exploration, development, and production effort than Alternative 2, but larger than the No Action Alternative. The effects to public access on the Sioux Ranger District between 19 new wells (Alternative 3) and 28 new wells (Alternative 2) would be similar because only one to three wells could be constructed at one time. The main difference is that the duration of disruption would be shorter under Alternative 3 and in the case of North Cave Hills and Slim Buttes the wells and roads would be off-Forest.

Any roads that would be used for additional wells under new or existing leases would be maintained by the oil company utilizing those roads. Spur roads to well sites would be closed to public traffic. Any NFS roads that are not up to the standard required for truck use would be improved by the oil company. Traffic controls would be maintained by the oil company as required by the Manual Uniform Traffic Control Devices (MUTCD). A Road Use Agreement or a Commercial Road Use Permit would be required by the Forest Service for oil company use of National Forest System Roads. Some roads may be located off-Forest. These roads would not be subject to NFS lease stipulations.

This alternative assumes a combination of the RFD well and road projections (Appendix D) constrained by the Forest Plan standards, guidelines, and oil & gas stipulations.

North Cave Hills

Under Alternative 3, 1.5 miles of road are projected to be built to construct and maintain the five reasonably foreseeable new wells. These wells are all projected to be off-Forest within close proximity of the North Cave Hills unit. See Table 3.18-11.

Construction activity would result in a total of approximately 70 truck trips to the five projected well locations for 16 to 42 days each. See Table 3.18-12. Approximately 50 car trips by workers would be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS Road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on Forest access roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck would be expected to visit the three new sites and the two existing sites once per day. These vehicle trips would not be expected to lower the current Traffic Service Level below a TSL D and it would be for a short duration, approximately one month. Maintenance trips would be made by the same truck to most of the locations and would

Table 3.18-11. Miles of Projected Roads¹, Truck, and Car Trips within each Land Unit under Alternative 3

Unit	Acres	Number of Projected New Wells	Miles of Existing NFRs	Projected Miles of Road	% Increase in Miles of NFRs	Number of Truck Trips ²		Number of Car Trips ²	
						Construction	Maintenance	Construction	Maintenance
North Cave Hills	14,547	5	45.13	1.5	Roads off Forest	70	16	50	0
South Cave Hills	8,876	9	29.28	3.3	11.3%	126	22	90	0
Slim Buttes	46,972	2	93.37	0.6	Roads off Forest	28	8	20	0
West Short Pines	1,263	2	3.58	0.3	8.4%	28	8	20	0
East Short Pines	6,147	1	12.41	0.0	0%	14	2	10	0
Total	77,805	19	183.77	5.7	2.0%	266	56	190	0

¹ Projected miles of roads are based on scenarios provided by the RFD. For purposes of Air Quality Analysis, slightly higher numbers were used (4.28 acres per well road, 3.5 acres per well pad) in order to capture the greatest potential impact to air quality.

² Total during construction period.

not create a long-term drop in TSL. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 3. Public access to National Forest System lands would not be expected to change dramatically under Alternative 3 due to this number of vehicle trips. Vehicle trips would be spread over time and distance and would be not expected to cause an increase to traffic congestion or cause any limit to access by the public.

Table 3.18-12. Public Access to North Cave Hills under Alternative 3

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	70 total (14 per day on average at 5 locations)	50 total (10 on average at 5 locations)
Maintenance Activity	16 total trips (1 pumper truck per day to and from 8 locations, 3 existing, 5 projected wells)	None

South Cave Hills

Under Alternative 3, approximately 3.3 miles of road, representing an increase of 11.2 percent, would be built to construct and maintain nine new wells within the South Cave Hills unit. See Table 3.18-13. As stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this would represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan (USFS 1987a, pages 36-37) guidelines.

Construction activity would result in a total of approximately 126 truck trips to the nine projected well locations for 16 to 42 days each. See Table 3.18-13. Approximately 90 car trips by workers would be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck would be expected to visit the nine new sites and the one existing site once per day. These vehicle trips would not be expected to lower the current Traffic Service Level below a TSL D and it would be for a short duration, approximately one month. Maintenance trips would be made by the one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 3 due to this number of vehicle trips. Vehicle trips would be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 3.

Table 3.18-13. Public Access to the South Cave Hills under Alternative 3

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	126 total (14 per day on average at 9 locations)	90 total (10 on average at 9 locations)
Maintenance Activity	20 total trips (1 pumper truck per day to and from 10 locations, 1 existing, 9 projected wells)	None

Slim Buttes

Under Alternative 3, 0.6 miles of road are projected to be built to construct the two reasonably foreseeable dry gas wells. These wells are all projected to be off-Forest within close proximity of the Slim Buttes unit. See Table 3.18-11.

Construction activity would result in a total of approximately 28 truck trips to the two projected well locations for 16 to 42 days each. See Table 3.18-14. Approximately 20 car trips by workers would be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on Forest access roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

Since both wells are projected to be dry, there would be no maintenance trips.

Vehicle trips would be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 3.

Table 3.18-14. Public Access to Slim Buttes under Alternative 3

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	28 total (14 per day on average at 2 locations)	20 total (10 on average at 2 locations)
Maintenance Activity	4 total trips (1 pumper truck per day to and from 2 projected wells)	None

West Short Pines

Under Alternative 3, 0.3 mile of new road would be built to construct and maintain two new wells within the West Short Pines unit. See Table 3.18-11. As stated in the Forest Plan (USFS 1987a, pages 36-37) these roads would not be open to the public and although this would represent a short-term irretrievable effect, it would not be substantial. These roads would be

decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity would result in a total of approximately 28 truck trips to the two projected well locations for 16 to 42 days each. See Table 3.18-15. Approximately 20 car trips by workers would be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck would be expected to visit the two new sites once per day. These vehicle trips would not be expected to lower the current Traffic Service Level and it would be for a short duration, approximately one month. Maintenance trips would be made by the one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 3 due to this number of vehicle trips. Vehicle trips would be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 3.

Table 3.18-15. Public Access to West Short Pines under Alternative 3

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	28 total (14 per day on average at 2 locations)	20 total (10 on average at 2 locations)
Maintenance Activity	4 total trips (1 pumper truck per day to and from 2 projected wells)	0

East Short Pines

Under Alternative 3, no new roads are projected to be built (under the RFD scenario) in order to construct and maintain the one new well within the East Short Pines unit. See Table 3.18-11. If roads were to be built, as stated in the Forest Plan (USFS 1987a, pages 36-37), these roads would not be open to the public and although this would represent a short-term irretrievable effect, it would not be substantial. These roads would be decommissioned at the end of the life of the project and allowed to return to a natural state per Forest Plan guidelines (USFS 1987a, pages 36-37).

Construction activity would result in a total of approximately 14 truck trips to the two projected well locations for 16 to 42 days each. See Table 3.18-16. Approximately 10 car trips by workers would be expected over the same period of time. Access to portions of the Forest could be inhibited if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related

trucks or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term, irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

During maintenance activity, one truck would be expected to visit the one new site once per day. These vehicle trips would not be expected to lower the current Traffic Service Level and it would be for a short duration, approximately one month. Maintenance trips would be made by one or two trucks to most of the locations and would not create a long-term drop in TSL. Public access to National Forest System lands would not be expected to change dramatically under Alternative 3 due to this number of vehicle trips. Vehicle trips would be spread over time and distance and would not be expected to cause an increase to traffic congestion or cause any limit to access by the public. No long-term change in TSL, direct, indirect, irreversible, long-term, or cumulative effects on public access would be expected under Alternative 3.

Table 3.18-16. Public Access to East Short Pines Unit under Alternative 3

Duration	Estimated Truck Trips During Construction Period	Estimated Car Trips During Construction Period
Construction Activity 16 to 42 days per well	14 total (14 per day on average at 1 location)	10 total (10 on average at 1 location)
Maintenance Activity	2 total trips (1 pumper truck per day to and from 1 projected well location.)	None

Direct Effects

Under Alternative 3, 19 new wells would potentially be constructed. Access to portions of the Forest could be inhibited in those 19 locations if a Forest visitor attempts travel on a NFS road at the same time as oil and gas-related truck trips or commuting workers. Additionally, Forest visitors who expect an isolated experience, such as hunters, could have a diminished experience due to additional traffic on NFS roads resulting from oil and gas leasing activities as well as from other Forest activities. Visitor perception of access could affect their experience. The temporary effects during construction represent a short-term (8 to 23 months), direct irretrievable interruption to public access (personal communication, Brenda Christensen, Custer National Forest, November 4, 2002).

Indirect Effects

No indirect effects to Public Access would be expected under Alternative 3.

Irreversible Effects

No irreversible effects to Public Access would be expected under the Alternative 3.

Irretrievable Effects

Irretrievable effects are described under *Direct Effects*.

Cumulative Effects

Cumulative effects include effects of oil and gas leasing activities as well as other activities that are expected to affect access by the public to Forest Lands.

Harding County has just completed the Cave Hills road improvement project. No other projects by the county are planned within the Oil and Gas Leasing potential project area. The South Dakota State Department of Environmental and Natural Resources cannot predict the amount of activity on state lands that would require permits through their office but not many are expected. The South Dakota State Department of Fish and Game, Buffalo Field Office, has ongoing projects with the Forest Service to maintain enclosures in sensitive habitat areas in Picnic Springs Campground, Reva Gap Campground, and at Fox Springs in East Short Springs, as well as ongoing fisheries management on two existing dams. They will also be participating in an upcoming Statewide Sage Grouse Conservation Plan. No adverse cumulative effects would be expected as a result of these projects.

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The Forest Service will continue with the following projects:

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- On-going reclamation of uranium mines
- Cleaning out sediment ponds and construction of new sediment pond in North Cave Hills
- Proposed Fuel Hazard Abatement Project, 1.5 miles along both sides of NFSR 3214
- Continued grazing

The BLM expects 150 new wells to be installed over the next three to four years in neighboring Bowman County, SD.

These activities are spread throughout Harding County (and Bowman County) and do not represent land usage in one small area. No substantial cumulative effects would be expected from Alternative 3 in addition to these other activities.