

APPENDIX A-I
ACTS OF AUTHORITY AND MANDATES FOR THE
BUREAU OF LAND MANAGEMENT

BACKGROUND ACTS

A series of statutes establish and define the authority of the Secretary of the Interior to make decisions regarding fluid minerals leasing and development. The major relevant statutes are briefly described below, and the subsequent permit and approval requirements are summarized in Table A-1 (at the end of Appendix A-I).

General Mining Law of 1872 (later amended by the Mineral Leasing Act of 1920)

Public land valuable for oil deposits were open to entry and placer mining claims under the General Mining Law (see Act of February 11, 1872, 29 Stat. 526). The General Mining Law of 1872 (30 USC 22-54) governs mining activity on public land. So many claims were filed under the General Mining Law that the President issued a Proclamation in 1909 withdrawing public land from such entry, pending the enactment of legislation to protect such land (see *U.S. v. Midwest Oil Co.*, 59 L.Ed. 673 [1915], and *Udall v. Tallman*, 13 L.Ed. 2d 616, 628 [1965]). However, protective legislation was not enacted until the Mineral Leasing Act of 1920 (see *Boesche v. Udall*, 373 US 472, 10 L.Ed. 2d 491, 497 [1963]). This Act established a leasing system for the acquisition of certain minerals (currently applies to coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas).

Mineral Resources on Weeks Law Lands

The Act of March 4, 1917 (39 Stat. 1150, as supplemented; 16 USC 520) authorizes the Secretary of the Interior to prescribe general regulations to permit prospecting, development, and use of the mineral resources of the lands acquired under the Act of March 1, 1911, known as Weeks Law, for the best interests of the United States.

ACTS OF AUTHORITY

Mineral Leasing Act of February 25, 1920

This Act is the primary authority under which the Federal government leases the majority of Federal onshore minerals. The Bureau of Land Management (BLM), Department of the Interior, is responsible for leasing under this Act. Technical administration of leases and permits is the responsibility of the U.S. Geological Survey. Certain lands are closed to leasing in Section 43 (30 USC 226-3).

Mineral Leasing Act for Acquired Lands of August 7, 1947

The Mineral Leasing Act (Ch. 513, 61 Stat. 913; 30 USC 351, 352, 354, 359) provides that all deposits of coal, phosphate, oil, oil shale, gas, sodium, potassium, and sulphur that are owned or may be acquired by the United States and that are within the lands acquired by the United States may be leased by the Secretary of the Interior under the same conditions as contained in the leasing provisions of the mineral leasing laws. No mineral deposit covered by this section shall be leased except with the consent of the head of the Executive Department, independent establishment, or instrumentality having jurisdiction over the lands containing such deposit, or holding a mortgage or deed of trust secured by such lands that is unsatisfied of record, and subject to such conditions as that official may prescribe to ensure the adequate use of the lands for the primary purposes for which they have been acquired or are being administered.

The Federal Onshore Oil and Gas Leasing Reform Act of December 22, 1987

The 1987 Leasing Reform Act (30 USC 181, et seq.; PL 100-203) requires the BLM to offer all lands available for leasing competitively prior to leasing noncompetitively and adds environmental provisions to the leasing process. The Act was a response to concerns that leasing often was occurring at below-market rates and to concerns about environmental protection. The Act also provides for inspections and enforcement of operations once commenced. In addition, the BLM is required to have the consent of the Forest Service before leasing oil and gas on Forest Service lands. Regulations implementing this statute were published in the *Federal Register* on March 21, 1990 (55 FR 10423, et seq.), and the regulations were codified in 36 CFR 228.100 et seq. Onshore oil and gas leasing and operations regulations are provided in 43 CFR Part 3100 et al.

Onshore Oil and Gas Leasing and Operations: Proposed Rule (43 CFR Part 3100, et. al.)

The BLM is proposing to revise its Federal oil and gas leasing and operations regulations (*Federal Register*, December 3, 1998). The proposed rule, as published, uses performance-based standards in certain instances in lieu of the current prescriptive requirements. BLM's onshore orders and national notices to lessees would be incorporated into these regulations to eliminate overlap with existing regulations. Also, the rule is intended to eliminate redundancies, clarify procedures and regulatory requirements, and streamline processes. Subpart 3104 of the proposed rule states that the BLM can include stipulations restricting surface use on leased land, or restrict the use of the lease after issuance through conditions of approval in order to protect environmental quality and resources, threatened or endangered species, cultural or historic resources, or private or other rights when the surface area is not managed by the BLM. Conditions of approval may include measures to modify the location or design of proposed operations, restrict timing of surface disturbance, or interim and final mitigation. Subpart 3120 discusses public land available to leasing. Recreation and Public Purpose land is subject to oil and gas leasing under stipulations, if appropriate. It should be noted that the proposed rule was

published in the *Federal Register* for review and comment by the public, and is subject to revision prior to becoming final.

Geothermal Steam Act of 1970

This Act (30 USC 1001 et seq.) gives BLM the authority to issue leases for the development of geothermal resources on Federal lands, given the assurance that the land may continue to be used adequately for the purposes for which it was withdrawn or acquired. Subsequently (in 1975 and 1977), Geothermal Resources Operational Orders 1-6 were issued under the Act by the U.S. Geological Survey Conservation Division. The orders provided direction for exploratory operations; drilling, completion, and spacing of geothermal wells; plugging and abandonment of wells; general environmental protection requirements; pipelines and surface production facilities; and production and royalty measurement, equipment, and testing procedures.

Geothermal Resources Leasing and Operations: Final Rule (43 CFR Part 3200, et al.)

A final rule issued in September 1998 amends the regulations that implement the Geothermal Steam Act of 1970 (*Federal Register*, September 30, 1998). The final rule revises 43 CFR parts 3200, 3210, 3220, 3240, 3250, and 3260, which implement the classification, leasing, exploration, drilling, and utilization requirements of the Act. These regulations affirmed that the BLM may issue geothermal leases on land administered by the Department of the Interior including public, withdrawn, and acquired lands; lands administered by the Department of Agriculture with their concurrence; lands conveyed by the United States government wherein geothermal resources were reserved to the United States; and lands subject to Section 24 of the Federal Power Act as amended (16 USC 818) with concurrence from the Secretary of Energy. The BLM cannot issue leases for land on which the Secretary of the Interior has determined the issuance of the lease could cause unnecessary and undue degradation of public land and resources; lands administered by the National Park Service or a National Recreation Area; lands where it is determined that a lease is likely to result in a significant adverse effect on a significant thermal feature within the National Park System (if activities resulting from a lease might result in such an effect, the BLM will include stipulations to protect the feature in the lease or permit); wildlife management areas or hatcheries administered by the Department of the Interior; or Indian trust or restricted lands.

MANDATES AND GUIDANCE FOR PLANNING AND ENVIRONMENTAL RESOURCES MANAGEMENT

Federal Land Policy and Management Act of 1976

The Federal Land Policy and Management Act (FLPMA) (43 USC 1700; et. seq.) and its implementing regulations define principles for management of public land and their resources. This Act directs the Secretary of Interior to develop, maintain, and when appropriate, revise land use plans that provide for the management of public land based on the principles of multiple use and sustained yield unless otherwise specified by law.

National Environmental Policy Act of 1969

This statute (40 USC 4331 et. seq.) and its implementing regulations (40 Part 1500) apply to all Federal actions including oil and gas leasing. This statute requires the Federally authorized officers in Federal agencies to perform environmental analysis and disclose the effects of their decisions on the quality of the human environment. The law further requires the Federal officers to identify and describe the significant environmental issues associated with their decisions, the proposed action and alternatives to the proposed action (including the alternative of no action) and identification of the effects of all alternatives on the environment. Federal officers must disclose the direct, indirect, and cumulative effects of the decisions, and adverse environmental effects that cannot be avoided, the relationship between short-term uses of the human environment and the maintenance of long-term productivity, and any irreversible or irretrievable commitments of resources made by the decision. Drilling on fluid mineral leases is evaluated on a case-by-case basis as part of the National Environmental Policy Act (NEPA) process.

The Clean Air Act of 1970

The Clean Air Act (91 Stat. 685; 42 U.S.C. 7401 et. seq.) provides that each state is responsible for ensuring achievement and maintenance of air quality standards within its borders so long as such standards are at least as stringent as Federal standards established by the U.S. Environmental Protection Agency (EPA).

The Endangered Species Act of 1973

The Endangered Species Act (PL 93-204; 16 USC 1531, et. seq.), as amended, requires special protection and management on Federal lands for threatened or endangered species. The U.S. Fish and Wildlife Service (FWS) is responsible for administration of this Act. Federal agencies proposing an action or processing an action proposed by a third party that “may affect” the existence of an identified species must consult with the FWS to determine if, and how, the proposed action would affect those

species. Mitigation measures are developed through the consultation process and are put forth as suggested conservation measures included in a formal FWS Biological Opinion as to whether or not the proposed action would jeopardize the continuous existence of any officially listed endangered or threatened species.

Clean Water Act

The Federal Water Pollution Control Act Amendments (PL 92-500, 86 Stat. 816, as amended; 33 USC 1251, et seq) put forth national standards to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Upon passage of Environmental Quality Acts and adoption of water quality standards, state agencies are empowered to enforce water quality standards as long as they are at least as stringent as Federal standards established by the EPA.

Also, Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers, requires that waters of the United States be protected by permits prior to dredge or fill activities occurring in such areas. Waters include intermittent streams, mud flats, and sand flats. Wetlands that meet jurisdictional criteria of Section 404 of the Clean Water Act are partially protected by the requirement of a permit prior to any dredge or fill activity occurring in such areas.

Historic Preservation Act of 1966

Section 106 of the National Historic Preservation Act (Public Law 89-665, 80 Stat. 915 [16 USC 470] as amended) requires that Federal agencies undertaking or funding projects consider the effects of proposal actions on historic resources eligible for or listed on the National Register of Historic Places regardless of land status. Regulations for *Protection of Historic Properties* (36 CFR Part 800) defines the process for demonstrating such consideration through consultation with State Historic Preservation Officers, the Federal Advisory Council on Historic Preservation, and other interested parties.

Energy Policy Act of 1992

The Energy Policy Act of 1992 (PL 102-486) addresses a broad range of energy issues, including energy efficiency and alternative fuel programs. Under this Act, the primary term of competitive leases was changed from 5 to 10 years.

BLM Manual Section 1624-2

BLM Manual Section 1624-2, Supplemental Program Guidance for Fluid Minerals, requires that fluid minerals determinations be included in every resource management plan prepared by BLM. The manual

also identifies factors that should be analyzed and considered in making fluid minerals determinations. BLM Handbook H-1624-1, Planning for Fluid Minerals Resources, provides direction for preparing the appropriate documentation for complying with the Supplemental Program Guidance.

Existing Management Direction in BLM's Decision Area

Specific to BLM's Decision Area, the BLM has prepared environmental and planning documents to address and direct fluid minerals leasing. The Environmental Assessment for Oil and Gas and Geothermal Leasing in the White Sands Resource Area (BLM 1981a) identified areas regionally where potential resource conflicts were significant enough to either preclude leasing or restrict lease operations. The mitigating measures developed from the Environmental Assessment (EA) were intended to be attached to leases as special stipulations. Other lease stipulations were developed for a statewide project conducted by the BLM New Mexico State Office (May 1982) and created provisions protecting soil resources from initial operation through final reclamation of lease surfaces. Plan documents including the White Sands Resource Management Plan (BLM 1986a) and the Otero County Area of Critical Environmental Concern Resource Management Plan Amendment (BLM 1997b) provide direction for fluid minerals management.

Also, the *Proposed Statewide RMPA/FEIS - New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management* was released in January 2000. The Proposed RMPA/FEIS documented the effects of adopting standards for public health and guidelines for livestock grazing management on BLM-administered public land in the State. The standards describe conditions needed for health-sustainable public rangelands and provide the measure of resource quality, condition, and function upon which the health of public land will be assessed. Changes to existing grazing practices may result to attain the new standard public land health, based on the need to retain the integrity of the soil and the continued sustainability of ecological processes. The Record of Decision for this project was signed April 5, 2000. Following the signing of the Record of Decision, the standards and guidelines were sent to the Secretary of the Interior for review and approval.

Onshore Oil and Gas Orders No. 1 and No. 2

Onshore Oil and Gas Orders No. 1 and No. 2 are authorized under 43 CFR Parts 3160 and 3180, and provide uniform national standards for performance and operations when conducting oil and gas exploration and development on public land. Onshore Order No. 1 requires conformance with Federal and State laws and regulations and ensures environmental safeguards, public health and safety, and proper reclamation of disturbed lands. Order No. 2 establishes specific requirements and standards for operation and equipment. (Refer to Proposed Rule 43 CFR Part 3100, et. al. above.)

Executive Orders 11988 and 11990

Executive Orders 11988 and 11990 place restrictions on government approval of construction activities in wetlands and floodplains, and require consideration of wetland and floodplain impacts in all documents prepared in compliance with NEPA.

NEW MEXICO STATE STATUTES

The following State statutes may not apply to the BLM, but generally are relevant to fluid mineral development in the State of New Mexico.

New Mexico Oil and Gas Act

The New Mexico Oil and Gas Act (Chapter 70, Article 2 NMSA 1978) establishes procedures for leasing, royalties, and operations for the oil and gas industry. The Act also created the Oil Conservation Commission and provided it the jurisdiction and authority over all matters relating to the conservation of oil and gas and prevention of waste of potash as a result of oil and gas operations in the State of New Mexico. Permitting is administered through the Oil Conservation Division of the Energy, Minerals, and Natural Resources Department.

New Mexico Geothermal Resources Act

The New Mexico Geothermal Resources Act (Chapter 75, Article 15 NMSA 1973) regulates the development of geothermal resources on State lands. It includes leasing procedures, royalty rates, and leasing terms.

New Mexico Geothermal Resources Conservation Act

The New Mexico Geothermal Resources Conservation Act (Chapter 71, Article 5 NMSA 1978) is intended to ensure that geothermal resources are developed efficiently while safeguarding public health and natural resources. The Act provides the authority to the Oil Conservation Commission and the Oil Conservation Division of the Energy, Minerals, and Natural Resources Department to administer it.

State Cultural Properties Act of 1977

The State Cultural Properties Act requires that survey work for archaeological sites be conducted prior to any development of State or Federal lands. The Act provides the authority to grant archaeological permits to the State Archaeologist.

New Mexico Water Quality Act

The New Mexico Water Quality Act (Chapter 74, Article 6 NMSA 1978) allows for water pollution control problems to be established by the Water Quality Control Commission. Permitting and other regulatory authority for these programs may fall under the jurisdiction of the Environmental Improvement Division of the New Mexico Health and Environment Department, the Oil Conservation Division, or the State Engineer's Office, depending on the nature of the water used and method of discharge.

**TABLE A-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS¹**

Agency and Permit/Approval	Nature of Action	Authority	Application
Federal Permits, Approvals, and Authorizing Actions			
<i>BLM</i>			
Decision Record for proposed action	Evaluate environmental impacts of proposed action	NEPA	Proposed Federal action
Permit to Drill	Provide for compliance with regulations and requirements during drilling and completion phases of the well	Mineral Leasing Act of 1920; Federal Oil and Gas Royalty Management Act of 1982; Secretarial Order No. 3087; Amendment No. 1, February 7, 1983	Proposed injection wells and gas production wells
Rights-of-way	Grant right-of-way and potentially evaluate the environmental impacts of proposed action	NEPA, FLPMA, Mineral Leasing Act of 1920	Pipeline, electrical lines, access roads
Notice of Intent to conduct geophysical exploration	Protect resource values during geophysical exploration activities	FLPMA, Mineral Leasing Act of 1920	Proposed action
Approval to dispose of produced water	Controls disposal of produced water from Federal leases	Mineral Leasing Act of 1920	Well
Permit to use earthen pit (part of Application for Permit to Drill)	Regulates reserve pits on drilling locations	Mineral Leasing Act of 1920	Well
Authorization for flaring and venting of gas	Regulates flaring and venting of gas	Mineral Leasing Act of 1920	Well testing and evaluation
Temporary abandonment of a well	Regulates temporary abandonment of wells	Mineral Leasing Act of 1920	Successful well
Plugging and abandonment of a well	Establishes procedures for permanent abandonment	Mineral Leasing Act of 1920	Dry hole

TABLE A-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS¹

Agency and Permit/Approval	Nature of Action	Authority	Application
<i>U.S. Army Corps of Engineers</i>			
Section 404 permit	Issue a permit for placement of fill or dredge materials in waters of the United States or adjacent wetlands	Section 404, Clean Water Act	Pipeline; proposed actions in waters of the United States
<i>U.S. Fish and Wildlife Service</i>			
Consultation process, threatened or endangered species	Review potential impacts on Federally listed and candidate threatened and endangered species	Section 7 of the Endangered Species Act	Federal action
<i>EPA</i>			
(Administered by New Mexico Water Quality Control Commission) Stormwater discharge permits (National Pollutant Discharge Elimination System permits)	Regulate discharge to surface waters from point sources	Federal Water Pollution Control Act Amendments and Section 404(p) of Clean Water Act	Construction activities disturbing five or more acres (As of 01/26/02, the acreage will be reduced from 5 or more to 1 acre)
Permit for approval to dispose produced water (also must be approved by the surface management agency)	Issue permit to allow underground injection of produced water	Federal Safe Drinking Water Act, 40 CFR Parts 144 and 147	Underground injection control
(Administered by the Oil Conservation Division of the New Mexico Energy and Minerals Department) Underground Injection Control permit	Ensure potable aquifers are not adversely affected by injection of produced water	Federal Safe Drinking Water Act Underground Injection Control program (40 CFR Parts 144 and 146.22 and 40 CFR Parts 100 to 149, July 1, 1991 revision) Onshore Order No. 7	New injection well
Spill prevention, control, and countermeasure plan	Pollution control	40 CFR Part 112	Drilling operations

**TABLE A-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS¹**

Agency and Permit/Approval	Nature of Action	Authority	Application
State or Local Permits, Approvals, and Authorizing Actions			
<i>New Mexico State Historic Preservation Officer</i>			
Cultural resource clearance	Review and consultation	Historic Preservation Act of 1966, State Cultural Properties Act of 1977	All proposed action components
<i>New Mexico State Engineer's Office</i>			
Permit to appropriate groundwater within declared groundwater basins	Regulate groundwater use, permit for water wells	New Mexico Oil and Gas Act; New Mexico Geothermal Resources Act; Water Quality Act	All well development
<i>New Mexico Energy, Minerals, and Natural Resources Department - Oil Conservation Division</i>			
Permit to drill, re-enter, deepen, plugback, or add a zone (Form C-101)	Permit new wells	New Mexico Oil and Gas Act; New Mexico Geothermal Resources Act	New well development
Request for allowable and authorization to transport oil and natural gas (Form C-104)	Permit new wells	New Mexico Oil and Gas Act; New Mexico Geothermal Resources Act	New well development
Spill report	Notification of fire, breaks, leaks, spills, and blowouts	OCD Rule 116	In the event of fire, breaks, leaks, spills, and blowouts at drilling operations
<i>New Mexico Environmental Department - Air Quality Division</i>			
Air emission permits			Combustion sources, compressors, volatile chemical handling, storage piles, and storage tanks

TABLE A-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS¹

Agency and Permit/Approval	Nature of Action	Authority	Application
<i>Sierra and Otero Counties</i>			
May require road use permits	Permits for the use of overweight or overlength trucks on county roads		
Some sites may be associated with zoning codes or building code standards			

¹This list is not necessarily all-inclusive. It is the responsibility of the operator to ensure that all permits and approvals are secured before a project may proceed.

APPENDIX A-II LEASE ISSUING PROCESS

INTRODUCTION

Exploration for resources is costly and speculative. Companies must commit costly equipment, purchase a variety of land rights, and use expensive environmental protection technologies to begin exploratory drilling. Driven by pressures to be efficient and minimize risk, the nature of the enterprise has evolved over decades into a form in which exploration and development requires long-term planning by many loosely associated, mutually dependent industries. There is no guarantee that the expensive commitment of exploratory resources will result in a discovery.

Consequently, companies or individuals pursuing fluid minerals must be able to plan in advance to use their exploratory resources most efficiently. One tactic they rely on to stage commitments of their own resources is the purchase of public land leases. Developers want to know what lands are available for exploration and development and they want to be assured of continued future opportunities. Leasing of public land is a way to do this.

LEASE

A lease is (1) a contract in legal form that conveys to an operator the right to develop and produce fluid minerals for a specific period of time under certain agreed upon terms and conditions and (2) the tract of land, on which the lease has been obtained, where producing wells and production equipment are located.

Individuals, associations of citizens, and corporations organized under the laws of the United States or any state, are entitled to lease Federal lands for these purposes under authority of the Mineral Leasing Act of 1920, as amended, and by the Mineral Leasing Act for Acquired Lands of 1947 unless the lands have been specifically withdrawn by the Department of the Interior. Leases also may be issued to a legal guardian or trustee on behalf of a minor. Aliens, whose country of origin does not deny similar privileges to United States citizens, may hold interest in leases, but only through stock ownership of United States corporations that hold leases. Aliens may not hold interest in Federal fluid minerals leases through units in publicly traded limited partnerships.

The issuance of a lease grants to the lessee the exclusive right to use as much of the leased lands as is necessary to conduct exploratory drilling and development operations in the leasehold subject to stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statutes; and such reasonable measures as may be required by the surface-management agency's Authorized Officer to minimize adverse impacts on other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed (Application for Permit to Drill [APD]) provided they do not exceed the terms of the lease. To the extent consistent with lease rights granted, such

reasonable measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specifications of interim and final reclamation measures. Measures shall be deemed consistent with the lease rights granted provided that they do not require relocation of proposed operations by more than 200 meters, require that operations be sited off the leasehold, or prohibit new surface disturbing operations for a period in excess of 60 days in an lease year (43 CFR 3102.1-2).

A copy each of Form 3100-11, Offer to Lease and Lease for Oil and Gas, and Form 3200-24, Offer to Lease and Lease for Geothermal Resources, are provided at the end of this appendix.

Competitive and Noncompetitive Leases

Competitive and noncompetitive leases may be obtained for fluid minerals exploratory drilling and development on lands owned or controlled by the Federal government. The Leasing Reform Act of 1987 requires all public lands available for fluid minerals leasing to be offered first by competitive leasing at an oral auction. Noncompetitive leases may be issued only if the competitive process results in no bids. Competitive and noncompetitive leases are issued for a 10-year period. Both are extended for the duration that they are producing fluid minerals in paying quantities. The maximum competitive lease size is 2,560 acres in the "lower" 48 states and 5,760 acres in Alaska. The maximum noncompetitive lease size is 10,240 acres in all states.

Competitive Leases

The Bureau of Land Management (BLM) conducts oral auctions for leases on at least a quarterly basis, when there are available parcels of land. A Notice of Competitive Lease Sale lists lease parcels to be offered at auction. The Sale Notice is published at least 45 days before the date of the auction. The Sale Notice identifies any lease stipulations to uses or constraints on surface occupancy. There are three sources for Federal lands available for lease:

1. existing leases that have expired, and leases that have been terminated, canceled, or relinquished
2. parcels identified by informal expressions of interest from either the public or BLM for management reasons
3. lands included in offers filed for noncompetitive leases (effective January 3, 1989)

On the day of the auction, successful bidders must submit a properly executed lease bid form and make a payment consisting of an administrative fee (\$75 per parcel), one-year advance rental (\$1.50 per

acre), and not less than the \$2.00 per acre minimum bonus. The balance of the bonus bid must be received within ten working days of the auction. The bid form constitutes the legally binding lease offer.

Noncompetitive Leases

Noncompetitive leases may be issued only for parcels that have been offered competitively and failed to receive a bid. Lands in expired, terminated, canceled, or relinquished leases are not available for noncompetitive leasing until they have been offered competitively. After an auction, all lands that were offered competitively without receiving a bid are available for filing of noncompetitive offers for a period of two years.

Noncompetitive offers must be submitted on a BLM-approved form, and include a \$75 filing fee and one-year advance rental (\$1.50 per acre).

Noncompetitive lease offers filed on the first business day following the auction are considered as having been filed simultaneously. The priority among multiple offers received on the first business day for the same parcel are determined by drawings open to the public.

Lease Restrictions

As mentioned above, a lease does not convey an unlimited right to explore or an unlimited right to develop any fluid mineral resources found under the land. Leases are subject to terms and conditions. There are standard lease terms printed on the lease form (Forms 3011-11 and 3200-24) and there are restrictions derived from legal statutes and measures to minimize adverse impacts on other resources and are generally characterized in a lease as stipulations. Stipulations modify the standard lease terms the government grants to a lessee and are known by potential lessees prior to any sale and must be applied at the time of an APD. Standard lease terms and stipulations are described in more detail in Appendix A-V.

FEDERAL FLUID MINERALS LEASING - THE STAGED DECISION PROCESS

The legally required, staged-decision process is designed to accommodate the tentative nature of fluid minerals (in particular, oil and gas) exploration and development.

Purchasing leases does not automatically or immediately result in drilling exploratory wells on these leaseholds. Exploration companies must match geologic characteristics with the commitment of technology, capital, available equipment, and market conditions in a decision to risk a drilling operation. This may result in Federal land leases being bought, relinquished, allowed to expire, or leases may be bought and sold again without ever being drilled upon. This demonstrates a major distinction between

fluid minerals leasing and other activities that are authorized by the BLM. Most activities are reasonably certain to proceed to development after the permit or contract is issued. Although the effects of a typical well in a given location can be estimated on the basis of past experience, there is uncertainty at the time of lease authorization as to whether and when a well will be drilled.

The Federal government wants to respond to industry concerns, but must ensure that future activities will neither unduly harm the environment nor unduly interfere with their mandate of multiple use and sustained yield. A regulatory framework has been created to meet industry's needs while protecting other resources. The regulations include staged permitting of exploration and development. Those stages include public disclosure at the following decision points: (1) determination of lands available for leasing, (2) decision to lease specific lands, (3) APD, and (4) analysis of field development if production is established. The staged process is designed to minimize the risk of making a decision that could lead to undisclosed irreversible or irretrievable environmental impacts. Each decision is based on environmental analysis and disclosure of the probable effects in accord with the National Environmental Policy Act (NEPA). Each decision is appealable to the responsible Federal agency.

Lands Available for Leasing

This stage of the process will be satisfied by the decision resulting from this Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS). As required, the decision will identify the lands that are closed to leasing or open for leasing with or without stipulations and how fluid minerals exploration and development activities will be managed to protect other resources on public lands and private lands overlying Federal fluid minerals. The RMPA will direct BLM's fluid minerals program only, but grants no rights to other parties to proceed with fluid minerals activities and does not initiate ground-disturbing activities.

Leasing Decisions for Specific Lands

Regulations require the following before consent can be given for one or more leases to be issued by the BLM:

- # verifying that leasing on the specific lands has been adequately addressed in a NEPA document, and is consistent with the Resource Management Plan (RMP)
- # ensuring that conditions of surface occupancy are properly included as stipulations in resulting leases
- # determining that operations and development could be allowed somewhere on each proposed lease, except where stipulations would prohibit all surface occupancy

Application for Permit to Drill

Subsequent to a lease award, the proposed activities for drilling each well are submitted to BLM for approval by the operator through an APD and Surface Use Plan of Operation (SUPO). The BLM will analyze site-specific environmental effects of the proposed operations and issue a decision document (e.g., environmental assessment).

If modification or changes in the APD are needed, based on drilling conditions encountered or some other unforeseen circumstance, the operator submits a Sundry Notice to the BLM for review and approval. Depending on the extent and nature of the change, additional NEPA analysis may be needed.

Field Development Plan

If economically recoverable quantities of oil and gas or geothermal resources are found through exploratory drilling, industry may submit a field development plan after evaluation of the discovery wells and available geologic information. BLM would analyze the environmental effects associated with the proposed field development and identify reasonable and necessary mitigation measures. Specific well sites and access routes may not be known at the time the field development plan is analyzed. In such cases, additional NEPA analysis, tiered to the field development plan, may be required once a specific well is proposed.

IMPACTS OF A LEASE DECISION

The authorization of a lease grants rights to conduct exploratory drilling and develop fluid minerals within the terms and stipulations of the lease. The exercise of these rights results in environmental effects. The regulations direct the BLM to consider the subsequent actions that would be authorized by a lease, and their potential environmentally disturbing effects, as connected actions. These actions also meet the definition of connected actions in the procedural requirements for NEPA (40 CFR 1502).

These expected actions are the basis of the environmental analysis from which the leasing decisions will be made. The decision on the lands that are available and the subsequent decision authorizing leases, are based upon analysis of the likely environmental effects of the connected actions.

FORM 3100-11
OFFER TO LEASE AND LEASE FOR OIL AND GAS

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
OFFER TO LEASE AND LEASE FOR OIL AND GAS

Serial No. _____

The undersigned (reverse) offers to lease all or any of the lands in Item 2 that are available for lease pursuant to the Mineral Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181 et seq.), the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351-359), the Attorney General's Opinion of April 2, 1941 (40 Op. Atty. Gen. 41), or the

READ INSTRUCTIONS BEFORE COMPLETING

1. Name
Street
City, State, Zip Code

2. This application/offer/lease is for: (Check only One) PUBLIC DOMAIN LANDS ACQUIRED LANDS (percent U.S. interest _____)

Surface managing agency if other than BLM: _____ Unit/Project _____

Legal description of land requested: *Parcel No.: _____ *Sale Date (m/d/y): ____ / ____ / ____

*SEE ITEM 2 IN INSTRUCTIONS BELOW PRIOR TO COMPLETING PARCEL NUMBER AND SALE DATE.

T. _____ R. _____ Meridian _____ State _____ County _____

Amount remitted: Filing fee \$ _____ Rental fee \$ _____ Total acres applied for _____
Total \$ _____

DO NOT WRITE BELOW THIS LINE

3. Land included in lease:

T. _____ R. _____ Meridian _____ State _____ County _____

Total acres in lease _____
Rental retained \$ _____

This lease is issued granting the exclusive right to drill for, mine, extract, remove and dispose of all the oil and gas (except helium) in the lands described in Item 3 together with the right to build and maintain necessary improvements thereupon for the term indicated below, subject to renewal or extension in accordance with the appropriate leasing authority. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of this lease, the Secretary of the Interior's regulations and formal orders in effect as of lease issuance, and to regulations and formal orders hereafter promulgated when not inconsistent with lease rights granted or specific provisions of this lease.

NOTE: This lease is issued to the high bidder pursuant to his/her duly executed bid or nomination form submitted under 43 CFR 3120 and is subject to the provisions of that bid or nomination and those specified on this form.

Type and primary term of lease:

THE UNITED STATES OF AMERICA

Noncompetitive lease (ten years)

by _____
(Signing Officer)

Competitive lease (ten years)

(Title) (Date)

Other _____

EFFECTIVE DATE OF LEASE _____

4. (a) Undersigned certifies that (1) offeror is a citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States or of any State or Territory thereof; (2) all parties holding an interest in the offer are in compliance with 43 CFR 3100 and the leasing authorities; (3) offeror's chargeable interests, direct and indirect, in each public domain and acquired lands separately in the same State, do not exceed 246,060 acres in oil and gas leases (of which up to 200,000 acres may be in oil and gas options) or 300,000 acres in leases in each leasing District in Alaska of which up to 200,000 acres may be in options; (4) offeror is not considered a minor under the laws of the State in which the lands covered by this offer are located; (5) offeror is in compliance with qualifications concerning Federal coal lease holdings provided in sec. 2(a)(2)(A) of the Mineral Leasing Act; (6) offeror is in compliance with reclamation requirements for all Federal oil and gas lease holdings as required by sec. 17(g) of the Mineral Leasing Act; and (7) offeror is not in violation of sec. 41 of the Act.

(b) Undersigned agrees that signature to this offer constitutes acceptance of this lease, including all terms, conditions, and stipulations of which offeror has been given notice, and any amendment or separate lease that may include any land described in this offer open to leasing at the time this offer was filed but omitted for any reason from this lease. The offeror further agrees that this offer cannot be withdrawn, either in whole or in part, unless the withdrawal is received by the proper BLM State Office before this lease, an amendment to this lease, or a separate lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States.

This offer will be rejected and will afford offeror no priority if it is not properly completed and executed in accordance with the regulations, or if it is not accompanied by the required payments. 18 U.S.C. Sec. 1001 makes it a crime for any person knowingly and willfully to make to any Department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Duly executed this _____ day of _____, 19 _____

(Signature of Lessee or Attorney-in-fact)

LEASE TERMS

Sec. 1. Rentals—Rentals shall be paid to proper office of lessor in advance of each lease year. Annual rental rates per acre or fraction thereof are:

- (a) Noncompetitive lease, \$1.50 for the first 5 years; thereafter \$2.00.
- (b) Competitive lease, \$1.50 for the first 5 years; thereafter \$2.00.
- (c) Other, see attachment, or

as specified in regulations at the time this lease is issued.

If this lease or a portion thereof is committed to an approved cooperative or unit plan which includes a well capable of producing leased resources, and the plan contains a provision for allocation of production, royalties shall be paid on the production allocated to this lease. However, annual rentals shall continue to be due at the rate specified in (a), (b), or (c) for those lands not within a participating area.

Failure to pay annual rental, if due, on or before the anniversary date of this lease (or next official working day if office is closed) shall automatically terminate this lease by operation of law. Rentals may be waived, reduced, or suspended by the Secretary upon a sufficient showing by lessee.

Sec. 2. Royalties—Royalties shall be paid to proper office of lessor. Royalties shall be computed in accordance with regulations on production removed or sold. Royalty rates are:

- (a) Noncompetitive lease, 12 1/4 %;
- (b) Competitive lease, 12 1/2 %;
- (c) Other, see attachment; or

as specified in regulations at the time this lease is issued.

Lessor reserves the right to specify whether royalty is to be paid in value or in kind, and the right to establish reasonable minimum values on products after giving lessee notice and an opportunity to be heard. When paid in value, royalties shall be due and payable on the last day of the month following the month in which production occurred. When paid in kind, production shall be delivered, unless otherwise agreed to by lessor, in merchantable condition on the premises where produced without cost to lessor. Lessee shall not be required to hold such production in storage beyond the last day of the month following the month in which production occurred, nor shall lessee be held liable for loss or destruction of royalty oil or other products in storage from causes beyond the reasonable control of lessee.

Minimum royalty in lieu of rental of not less than the rental which otherwise would be required for that lease year shall be payable at the end of each lease year beginning on or after a discovery in paying quantities. This minimum royalty may be waived, suspended, or reduced, and the above royalty rates may be reduced, for all or portions of this lease if the Secretary determines that such action is necessary to encourage the greatest ultimate recovery of the leased resources, or is otherwise justified.

An interest charge shall be assessed on late royalty payments or underpayments in accordance with the Federal Oil and Gas Royalty Management Act of 1982 (FOGRMA) (30 U.S.C. 1701). Lessee shall be liable for royalty payments on oil and gas lost or wasted from a lease site when such loss or waste is due to negligence on the part of the operator, or due to the failure to comply with any rule, regulation, order, or citation issued under FOGRMA or the leasing authority.

Sec. 3. Bonds—A bond shall be filed and maintained for lease operations as required under regulations.

Sec. 4. Diligence, rate of development, unitization, and drainage—Lessee shall exercise reasonable diligence in developing and producing, and shall prevent unnecessary damage to, loss of, or waste of leased resources. Lessor reserves right to specify rates of development and production in the public interest and to require lessee to subscribe to a cooperative or unit plan, within 30 days of notice, if deemed necessary for proper development and operation of area, field, or pool embracing these leased lands. Lessee shall drill and produce wells necessary to protect leased lands from drainage or pay compensatory royalty for drainage in amount determined by lessor.

Sec. 5. Documents, evidence, and inspection—Lessee shall file with proper office of lessor, not later than 30 days after effective date thereof, any contract or evidence of other arrangement for sale or disposal of production. At such times and in such form as lessor may prescribe, lessee shall furnish detailed statements showing amounts and quality of all products removed and sold, proceeds therefrom, and amount used for production purposes or unavoidably lost. Lessee may be required to provide plats and schematic diagrams showing development work and improvements, and reports with respect to parties in interest, expenditures, and depreciation costs. In the form prescribed by lessor, lessee shall keep a daily drilling record, a log, information on well surveys and tests, and a record of subsurface investigations and furnish copies to lessor when required. Lessee shall keep open at all reasonable times for inspection by any authorized officer of lessor, the leased premises and all wells, improvements, machinery, and fixtures thereon, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or in the leased lands. Lessee shall maintain copies of all contracts, sales agreements, accounting records, and documentation such as billings, invoices, or similar documentation that supports

costs claimed as manufacturing, preparation, and/or transportation costs. All such records shall be maintained in lessee's accounting offices for future audit by lessor. Lessee shall maintain required records for 6 years after they are generated or, if an audit or investigation is underway, until released of the obligation to maintain such records by lessor.

During existence of this lease, information obtained under this section shall be closed to inspection by the public in accordance with the Freedom of Information Act (5 U.S.C. 552).

Sec. 6. Conduct of operations—Lessee shall conduct operations in a manner that minimizes adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users. Lessee shall take reasonable measures deemed necessary by lessor to accomplish the intent of this section. To the extent consistent with lease rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-way. Such uses shall be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessee.

Prior to disturbing the surface of the leased lands, lessee shall contact lessor to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short term special studies under guidelines provided by lessor. If in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee shall immediately contact lessor. Lessee shall cease any operations that would result in the destruction of such species or objects.

Sec. 7. Mining operations—To the extent that impacts from mining operations would be substantially different or greater than those associated with normal drilling operations, lessor reserves the right to deny approval of such operations.

Sec. 8. Extraction of helium—Lessor reserves the option of extracting or having extracted helium from gas production in a manner specified and by means provided by lessor at no expense or loss to lessee or owner of the gas. Lessee shall include in any contract of sale of gas the provisions of this section.

Sec. 9. Damages to property—Lessee shall pay lessor for damage to lessor's improvements, and shall save and hold lessor harmless from all claims for damage or harm to persons or property as a result of lease operations.

Sec. 10. Protection of diverse interests and equal opportunity—Lessee shall: pay when due all taxes legally assessed and levied under laws of the State or the United States; accord all employees complete freedom of purchase; pay all wages at least twice each month in lawful money of the United States; maintain a safe working environment in accordance with standard industry practices; and take measures necessary to protect the health and safety of the public.

Lessor reserves the right to ensure that production is sold at reasonable prices and to prevent monopoly. If lessee operates a pipeline, or owns controlling interest in a pipeline or a company operating a pipeline, which may be operated accessible to be derived from these leased lands, lessee shall comply with section 28 of the Mineral Leasing Act of 1920.

Lessee shall comply with Executive Order No. 11246 of September 24, 1965, as amended, and regulations and relevant orders of the Secretary of Labor issued pursuant thereto. Neither lessor nor lessee's subcontractors shall maintain segregated facilities.

Sec. 11. Transfer of lease interests and relinquishment of lease—As required by regulations, lessee shall file with lessor any assignment or other transfer of an interest in this lease. Lessee may relinquish this lease or any legal subdivision by filing in the proper office a written relinquishment, which shall be effective as of the date of filing, subject to the continued obligation of the lessee and surety to pay all accrued rentals and royalties.

Sec. 12. Delivery of premises—At such time as all or portions of this lease are returned to lessor, lessee shall place affected wells in condition for suspension or abandonment, reclaim the land as specified by lessor and, within a reasonable period of time, remove equipment and improvements not deemed necessary by lessor for preservation of producible wells.

Sec. 13. Proceedings in case of default—If lessee fails to comply with any provisions of this lease, and the non-compliance continues for 30 days after written notice thereof, this lease shall be subject to cancellation unless or until the leasehold contains a well capable of production of oil or gas in paying quantities, or the lease is committed to an approved cooperative or unit plan or communitization agreement which contains a well capable of production of unitized substances in paying quantities. This provision shall not be construed to prevent the exercise by lessor of any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver shall not prevent later cancellation for the same default occurring at any other time. Lessee shall be subject to applicable provisions and penalties of FOGRMA (30 U.S.C. 1701).

Sec. 14. Heirs and successors-in-interest—Each obligation of this lease shall extend to and be binding upon, and every benefit hereof shall inure to the heirs, executors, administrators, successors, beneficiaries, or assignees of the respective parties hereto.

FORM 3200-24
OFFER TO LEASE AND LEASE FOR GEOTHERMAL RESOURCES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

OFFER TO LEASE AND LEASE FOR GEOTHERMAL RESOURCES

Serial No. _____

undersigned (see reverse) offers to lease all or any of the lands in item 2 that are available for lease pursuant to the Geothermal Steam Act of 1970 (30 U.S.C. 1001-1025)

Read Instructions Before Completing

1. Name _____

Street _____

City, State, Zip Code _____

2 Surface managing agency if other than BLM: _____ Unit/Project _____

Legal description of land requested (segregate by public domain and acquired lands):

T _____ R _____ Meridian _____ State _____ County _____

Total acres applied for _____

Percent U.S. interest _____

Amount remitted: Filing fee \$ _____

Rental fee \$ _____

Total \$ _____

DO NOT WRITE BELOW THIS LINE

3. Land included in lease:

T _____ R _____ Meridian _____ State _____ County _____

Total acres in lease _____

Rental retained \$ _____

In accordance with the above offer, or the previously submitted competitive bid, this lease is issued granting the exclusive right to drill for, extract, produce, remove, utilize, sell, and dispose of all the geothermal resources in the lands described in item 3 together with the right to build and maintain necessary improvements thereupon, for a primary term of 10 years. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of this lease, the Secretary of the Interior's regulations and formal orders in effect as of lease issuance and, when not inconsistent with lease rights granted or specific provisions of this lease, regulations and formal orders hereafter promulgated.

THE UNITED STATES OF AMERICA

Type of lease:

Noncompetitive

Competitive

Other _____

by _____ (Signing Officer)

(Title) (Date)

EFFECTIVE DATE OF LEASE _____

4. (a) Undersigned certifies that:

(1) Offeror is a citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States, any State or the District of Columbia; (2) All parties holding an interest in the offer are in compliance with 43 CFR 3200 and the authorizing Act; (3) Offeror's chargeable interests, direct and indirect, do not exceed that allowed under the Act; and (4) Offeror is not considered a minor under the laws of the State in which the lands covered by this offer are located.

(b) Undersigned agrees that signature to this offer constitutes acceptance of this lease, including all terms, conditions and stipulations of which offeror has been given notice, and any amendment or separate lease that may cover any land described in this offer open to lease application at the time this offer was filed but omitted for any reason from this lease. The offeror further agrees that this offer cannot be withdrawn, either in whole or part, unless the withdrawal is received by the BLM State Office before this lease, an amendment to this lease, or a separate lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States.

This offer will be rejected and will afford the offeror no priority if it is not properly completed and executed in accordance with the regulations, or if it is not accompanied by the required payments. Title 18 U.S.C. Sec. 1001 makes it a crime for any person knowingly and willfully to make to any Department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Duly executed this _____ day of _____, 19 _____

(Signature of Lessee or Attorney-in-fact)

LEASE TERMS

Sec. 1. Rentals—Rentals shall be paid to proper office of lessor in advance of each lease year until there is production in commercial quantities from the leased lands. Annual rental rates per acre or fraction thereof are: \$1 for noncompetitive leases and \$2 for competitive leases.

If this lease or a portion thereof is committed to an approved cooperative or unit plan which includes a well capable of producing leased resources, and the plan contains a provision for allocation of production, royalties shall be paid on the production allocated to this lease. However, annual rentals shall continue to be due for those lands not within a participating area.

Failure to pay annual rental, if due, on or before the anniversary date of this lease (or next official working day if office is closed) shall automatically terminate this lease by operation of law. Rentals may be suspended by the Secretary upon a sufficient showing by lessee.

Sec. 2. Royalties—Royalties shall be paid to proper office of lessor. Royalties shall be computed in accordance with regulations and orders. Royalty rates on production are: 10 percent for steam, heat, or energy; 5 percent for byproducts; and 5 percent for demineralized water.

Lessor reserves the right to establish reasonable minimum values on production after giving lessee notice and an opportunity to be heard. Royalties shall be due and payable on the last day of the month following the month in which production occurred.

A minimum royalty shall be due for any lease year beginning on or after the commencement of production in commercial quantities in which royalty payments aggregate less than \$2 per acre. Lessee shall pay such difference at the end of lease year. This minimum royalty may be waived, suspended, or reduced, and the above royalty rates may be reduced for all or portions of this lease if the Secretary determines that such action is necessary to encourage the greatest ultimate recovery of the leased resources, or is otherwise justified.

Sec. 3. Bonds—Lessee shall file and maintain any bond required under regulations.

Sec. 4. Diligence, rate of development, utilization, and drainage—Lessee shall perform diligent exploration as required by regulations and shall prevent unnecessary damage to, loss of, or waste of leased resources. Lessor reserves right to specify rates of development and production in the public interest and to require lessee to subscribe to a cooperative or unit plan, within 30 days of notice, if deemed necessary for proper development and operation of the area, field, or pool embracing these leased lands. Lessee shall drill and produce wells necessary to protect leased lands from drainage or pay compensatory royalty for drainage in amount determined by lessor.

Sec. 5. Documents, evidence, and inspection—Lessee shall file with proper office of lessor, not later than (30) days, after effective date thereof, any contract or evidence of other arrangement for the sale or disposal of production. At such times and in such form as lessor may prescribe, lessee shall furnish detailed statements showing amounts and quality of all products removed and sold, proceeds therefrom, and amount used for production purposes or unavoidably lost. Lessee may be required to provide plats and schematic diagrams showing development work and improvements, and reports with respect to parties in interest, expenditures, and depreciation costs.

In the form prescribed by lessor, lessee shall keep a daily drilling record, a log, and complete information on well surveys and tests and keep a record of subsurface investigations and furnish copies to lessor when required. Lessee shall keep open at all reasonable times for inspection by any authorized officer of lessor, the leased premises and all wells, improvements, machinery, and fixtures thereon, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or in the leased lands. Lessee shall maintain copies of all contracts, sales agreements, accounting records, and documentation such as billings, invoices, or similar documentation that support costs claimed as manufacturing, preparation, and/or transportation costs. All such records shall be maintained in lessee's accounting offices for future audit by lessor. Lessee shall maintain required records for 6 years after they are generated or, if an audit or investigation is underway, until released of the obligation to maintain such records by lessor.

Nothing in this lease shall prevent the public from obtaining information under this section shall be closed to inspection by the public in accordance with the Freedom of Information Act (5 U.S.C. 552).

Sec. 6. Conduct of operations—Lessee shall conduct operations in a manner that minimizes adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users. Lessee shall take reasonable measures deemed necessary by

lessor to accomplish the intent of this section. To the extent consistent with leased rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-ways. Such uses shall be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessees.

Prior to disturbing the surface of the leased lands, lessee shall contact lessor to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short term special studies under guidelines provided by lessor. If in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee shall immediately contact lessor. Lessee shall cease any operations that would result in the destruction of such species or objects.

Sec. 7. Production of byproducts—If the production, use, or conversion of geothermal resources from these leased lands is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water for beneficial uses in accordance with applicable State water laws, lessor may require substantial beneficial production or use thereof by lessee.

Sec. 8. Damages to property—Lessee shall pay lessor for damage to lessor's improvements, and shall save and hold lessor harmless from all claims for damage or harm to persons or property as a result of lease operations.

Sec. 9. Protection of diverse interests and equal opportunity—Lessee shall maintain a safe working environment in accordance with standard industry practices and take measures necessary to protect the health and safety of the public. Lessor reserves the right to ensure that production is sold at reasonable prices and to prevent monopoly.

Lessee shall comply with Executive Order No. 11246 of September 24, 1965, as amended, and regulations and relevant orders of the Secretary of Labor issued pursuant thereto. Neither lessee nor lessee's subcontractor shall maintain segregated facilities.

Sec. 10. Transfer of lease interests and relinquishment of lease—As required by regulations, lessee shall file with lessor, any assignment or other transfer of an interest in this lease. Lessee may relinquish this lease or any legal subdivision by filing in the proper office a written relinquishment, which shall be effective as of the date of filing, subject to the continued obligation of the lessee and surety to pay all accrued rentals and royalties.

Sec. 11. Delivery of premises—At such time as all or portions of this lease are returned to lessor, lessee shall place all wells in condition for suspension or abandonment, reclaim the land as specified by lessor, and within a reasonable period of time, remove equipment and improvements not deemed necessary by lessor for preservation of producible wells or continued protection of the environment.

Sec. 12. Proceedings in case of default—If lessee fails to comply with any provisions of this lease, and the noncompliance continues for 30 days after written notice thereof, this lease shall be subject to cancellation in accordance with the Act. However, if this lease includes land known to contain a well capable of production in commercial quantities, it may be cancelled only by judicial proceedings. This provision shall not be construed to prevent the exercise by lessor or any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver shall not prevent later cancellation for the same default occurring at any other time.

Whenever the lessee fails to comply in a timely manner with any of the provisions of the Act, this lease, the regulations, or formal orders, and immediate action is required, the Lessor may enter on the leased lands and take measures deemed necessary to correct the failure at the expense of the Lessee.

Sec. 13. Heirs and successors-in-interest—Each obligation of this lease shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

APPENDIX A-III

SURFACE USE AND BEST MANAGEMENT PRACTICES

INTRODUCTION

The locations of well sites are dictated by the geologic target to be drilled. Therefore, environmentally “ideal” locations for construction activities are not always coincident with the geologic target and avoidance of damage to surface resources is not always possible. It is neither possible nor practical to avoid all harm, and special practices or construction techniques may need to be employed to minimize impacts.

This appendix describes various types of practices that are designed to minimize surface disturbance and effects on other resources and retain the reclamation potential of the disturbed area. These practices may be general and apply nationwide, agency-wide, or regionally, or may be more specific and apply to a particular area or site. The practices represent effective and practical means of accomplishing the management goals and objectives of Bureau of Land Management (BLM) and should be used as a guide when preparing plans and details that are specific to individual projects.

Generally, the practices described in this appendix have been accepted and employed by industry for similar projects and/or have been derived from this Resource Management Plan Amendment (RMPA) analysis in response to issues identified during scoping and to address impacts identified during analysis. The standard practices are common to all alternatives described in Chapter 2 of this RMPA/Environmental Impact Statement (EIS).

The standard practices in this appendix should not be construed as rigid requirements that will be applicable to every situation. Rather, the ideas presented in this appendix communicate philosophy, approach, and examples that have been successful from which site-specific applications can be developed. The operator and surface-management agency working together can develop the best approach to achieve the management objectives in each situation.

While operations of Federal fluid minerals leases are managed by the BLM, the operations are managed in cooperation with the surface-management agency or surface owner, if it is other than the BLM, in order to guide surface use and management. Where the surface is privately owned, the operator is responsible for reaching an agreement with the private surface owner (refer to Chapter 2, Section 2-2).

The requirements and guidelines relevant to Federal fluid minerals are described briefly below.

SURFACE USE GUIDANCE

Onshore Oil and Gas Orders

Every oil and gas operation authorized under a Federal fluid minerals lease must comply with Federally mandated regulations and orders. Procedures are established for exploration of Federal oil and gas reserves in a series of Onshore Oil and Gas Orders, which are authorized by 43 CFR Part 3160 and 3180. These orders detail uniform national standards for minimum levels of performance expected from lessees and operators when conducting oil and gas activities on Federal and American Indian lands. Two orders are particularly relevant to determining the potential for environmental impacts associated with a proposed project. These are Onshore Oil and Gas Order Nos. 1 and 2.

Onshore Order No. 1 requires lessees and operators to conduct their exploration, development, production, and abandonment operations in a manner as follows:

- # conform with applicable Federal laws and regulations and with State and local laws and regulation to the extent that such State and local laws are applicable to operations on Federal or Indian leases
- # conform with the lease terms, lease stipulations, and conditions of approval
- # ensure diligent development and efficient resource recovery
- # protect the lease from drainage
- # afford adequate safeguards for the environment
- # ensure proper reclamation of disturbed lands
- # conform with currently available technology and practice
- # ensure that underground sources of fresh water will not be endangered by any fluid injection operation
- # otherwise ensure the protection of public health and safety

The order holds the lessee “fully accountable for their contractors’ and subcontractors’ compliance with the requirements of the approved permit and/or plan.”

Onshore Order No. 1 specifically requires survey work and a related report if the surface-management agency has reason to believe that properties listed, or eligible for listing, on the National Register of Historic Places are present in the area of potential effect. The order also requires the surface-

management agency to identify any threatened and endangered species and/or critical habitat problems and other environmental concerns (e.g., wilderness and wilderness study areas, known or potential surface geological hazards, etc.).

BLM Manual 3160 provides guidelines and procedures for processing Applications for Permits to Drill (APDs) and subsequent operations. BLM Manual Handbook 3160-1 provides guidelines for review of technical and environmental considerations for APDs and subsequent activities.

Onshore Order No. 2 established specific and detailed requirements along with minimum standards for the following:

- # well control during drilling
- # casing and cementing
- # drilling mud and circulating system
- # drill-stem testing
- # special drilling operations
- # blowout preventer equipment to prevent the uncontrolled release of formation fluids to the surface
- # related surface use
- # abandonment of drilling operations

In some instances, Onshore Order No. 2 relies on existing standards prepared by the American Petroleum Institute, Occupational Safety and Health Administration, and other organizations or agencies.

Onshore Order No. 6 addresses operations with hydrogen sulfide associated and Onshore Order No. 7 addresses disposal of produced water in pits and wells.

Geothermal Resources Operations

The Geothermal Resources Leasing and Operations Rule (43 CFR Part 3200, et al) described in Appendix A-1 provides direction for conducting exploration operations (Subpart 3252), drilling operations (Subpart 3262), and abandonment (Subpart 3263).

Standard Lease Terms

Standard lease terms, which are disclosed on the standard lease forms, indicate that the operator is responsible for diligent development and to conduct operation in a manner that minimizes adverse impacts on resources anywhere within the leasehold. Copies of standard Form 3100-11, Offer to Lease and Lease for Oil and Gas, and Form 3200-24, Offer to Lease and Lease for Geothermal Resources are provided at the end of Appendix A-II.

In addition to the standard lease terms and conditions, the BLM authorized officer may require site-specific mitigation at the time of an APD at a specific site. These mitigation measures would be attached to the APD as conditions of approval (described below).

Lease Stipulations

Constraints in the form of stipulations are conditions included in a lease when environmental and planning analyses have demonstrated that additional and more stringent environmental protection is needed. Stipulations are provisions that modify the standards lease rights and are attached and made part of the lease. The operator would be expected to comply with the stipulations specific to resource concerns that are attached to a lease (as described in Chapter 2 and Appendix A-V).

Surface Operating Standards

Minimum standards for design, construction, and operations, primarily in the Rocky Mountain States, are set forth in the Surface Operating Standards for Oil and Gas Exploration and Development “Gold Book” prepared by the BLM and Forest Service Rocky Mountain Regional Coordinating Committee (January 1989). The Gold Book was developed to aid the operator in permit approval and the conduct of oil and gas operations on Federal lands during exploration, development, production, and abandonment. It is intended to give the operator general informational guidance on compliance with the operating requirements given in 43 CFR 3000, 36 CFR 228E, and Notice to Lessees that have, or will be, promulgated or issued. Information is provided for the preparation of surface use and drilling programs and includes the following information and guidelines:

- # responsibilities for geophysical operations on Federal lands
- # procedures for oil and gas operations
- # siting and construction procedures for well sites
- # planning, location, design, construction, maintenance, and operations of roads and access ways

- # design and construction of drainage structures
- # drilling operations and related surface-disturbing activities
- # production operations standards and objectives, approvals, reporting, notification, disposal of produced water, pollution control, hazardous waste management, inspections and enforcement
- # reclamation of pits, well pads, flowlines and pipelines, and roads
- # abandonment inspection, approval, release of bonds

Copies of the Gold Book are available in limited quantities from the New Mexico State Office of the BLM.

Conditions of Approval

Additional constraints may be necessary if the authority to manage the activity on the lease does not already exist under laws, regulations, or orders.

Constraints in the form of conditions of approval of an APD are site-specific requirements or measures imposed to protect resources or resource values. Conditions of approval must be reasonable and consistent with lease rights. The authorized officer has the authority to relocate facilities (up to 656 feet [200 meters]), control timing (delay for 60 days), and impose other mitigation under Sections 2 and 6 of the standards lease terms (BLM Forms 3100-11 and 3200-24 are provided at the end of Appendix A-II). Potential mitigation measures that could be conditions of approval are addressed in Chapter 4 of this RMPA/EIS.

Best Management Practices

More specific to a region or area, a surface-management agency may have standards, or best management practices, to which an operation should conform. While the goals and philosophies regarding surface management are similar in intent, the operator must be responsible for understanding the requirements of the pertinent surface-management agency. Knowledge of the management plans of the surface-management agency, as well as agency operational standards, procedures, and environmental protection requirements, will help an operator meet these standards. The best management practices described below were developed by the Las Cruces Field Office of BLM for this RMPA/EIS.

BLM BEST MANAGEMENT PRACTICES

The best management practices described below apply to any fluid minerals project on public land within the Planning Area, and supplement the standards and guidelines from sources described above.

Preliminary Investigations

Activities occurring during preliminary investigations may include remote sensing; mapping of rock outcrops and seeps (either of which result in little or no surface disturbance); and seismic, gravity, and magnetic surveys (refer to Appendix B for more information).

A lease is not required to conduct such preliminary investigations. However, the geophysical operator is required to file a completed Form 3150-4, "Notice of Intent to Conduct Oil and Gas Exploration Operations" for all operations on public lands.

In general, BLM requires an examination of resource values and development of appropriate surface protection and reclamation measures prior to beginning surface disturbing activities associated with preliminary investigations. A copy of Form 3150-4a, Terms and Conditions for Notice of Intent to Conduct Geophysical Exploration is provided at the end of this appendix. Compliance monitoring should occur during and after seismic exploration activities when or if necessary. Compliance inspections during the operation ensure that requirements and guidelines are being followed. Compliance inspections upon completion of work ensure that the lines are clean and drill holes are plugged properly.

The frequency of authorized seismic exploration will be dependent upon resource conditions and seasonal restrictions (timing limitations) that may be imposed to reduce conflicts with watershed conditions, wildlife, and hunting. Management practices specific to wildlife and vegetation resources include the following:

- # Prior to surveying/flagging routes for geophysical surveys or other preliminary activities during the raptor breeding season, the project area shall be surveyed for raptor nests. Surveys shall be conducted by professional biologists approved by the Authorized Officer. The Universal Transmercator grid (UTM) locations of all raptor nests shall be reported to the Authorized Officer. All active raptor nests should be avoided by the required distances per the stipulation of controlled surface use. An "active raptor nest" is defined as any raptor or corvid nest being during the current nesting season.

- # In areas that constitute occupied or potential aplomado falcon habitat, a protocol survey for this species shall be conducted along with the general raptor nest survey described above, prior to surveying/flagging lines during the breeding season.

- # During operations at any time, large (greater than 6 feet [1.8 meters] in height) trees or shrubs containing or capable of containing a raptor nest shall be avoided by vehicular traffic or other activities likely to destroy them.
- # Throughout preliminary investigations and subsequent activities, operators (not BLM) are responsible for compliance with the Migratory Bird Treaty Act. Operators should coordinate with the U.S. Fish and Wildlife Service on actions likely to “take” migratory birds.
- # Time activities to avoid wet periods.
- # Minimize the off-road impact of large vehicles. Use wide, flat-tread, balloon tires (especially on seismic “thumper” trucks) where possible. Use all-terrain vehicles rather than large vehicles where possible.
- # Avoid vehicle use on slopes greater than 4 percent.

Administrative Requirements

The operator and its contractors and subcontractors will conduct all operations in full compliance with all applicable Federal, State, and local laws and regulations; applicable lease stipulations; and guidelines specified in the APD unless a written modification, waiver, or exception from the Authorized Officer has been granted (if action is acceptable with proper mitigation).

Prior to commencing construction activities, the operator and its contractors and subcontractors may conduct a preconstruction conference with the BLM Authorized Officer. Environmental and safety training will be part of the operator, contractor, and subcontractor training prior to construction. All employees will be familiarized with the resource protection policies of the BLM, requirements, and mitigating measures incorporated into each project.

The Authorized Officer will guide the project during all stages of the project including construction of roads and well pad, drilling and completion of the well, reclamation, preparation for production, and abandonment.

Surface Use

Roads

BLM encourages the use of existing roads to the maximum extent practical and minimizing new roads in unroaded areas. Where new roads are needed, construction, maintenance, rehabilitation, abandonment, and closure of the roads on public land will be in accordance with the BLM New

Mexico State Office Road Policy, Standards and Procedures (Instruction Memorandum No. NM-95-031).

Well Sites

In siting facilities at the well site, the following measures must be followed:

- # Minimize disturbance to existing fences and other improvements on public land.
- # Avoid livestock and wildlife water supplies by 0.25 mile (400 meters).
- # Surface disturbance is not permitted within 656 feet (200 meters) of existing wildlife improvements.
- # Prior to surveying/flagging locations for pads, routes for roads, and other preliminary activities, during the raptor breeding season, the project area shall be surveyed for raptor nests. Surveys shall be conducted by professional biologists approved by the Authorized Officer. All active raptor nests shall be avoided during the dates and by the distances listed below. An “active raptor nest” is defined as any raptor or corvid nest being used during the current nesting season.

Distance:

- Eagle - 0.5 mile (800 meters)
- Peregrine falcon - 900 to 3,400 meters (consistent with the management zones in Johnson 1994)
- All other raptor species - 0.25 mile (400 meters)

Timing:

- Peregrine falcon - variable March 1 through October 16
- Aplomado falcon - January 1 through July 31
- All raptor species during observed nest establishment through fledgling

Other conditions of approval may be applicable resulting from BLM and U.S. Fish and Wildlife Service consultation, when applicable.

- # In areas that constitute occupied or potential aplomado facon habitat, a protocol survey for this species shall be conducted along with the above general raptor nest survey prior to surveying/flagging lines during the breeding season (January 1 through July 31).
- # During operations at any time, large (greater than 6 feet (1.8 meters) in height) trees or shrubs containing or capable of containing a raptor nest shall be avoided by vehicular traffic or other activities likely to destroy them.

- # Encourage protection of the Rio Grande – avoid surface disturbance where possible within 656 feet (200 meters) of the outer edge of the 100-year floodplain to protect riparian/aquatic systems and the integrity of the floodplain.
- # Site facilities to minimize in-channel excavation.
- # Avoid visual intrusions by locating facilities below hilltops (on slope or brow of hill) to minimize silhouetting against the skyline while avoiding hillside “cut and fill” as much as possible.
- # Select site that provides topographic and vegetative screening when feasible.
- # Avoid populated areas, parks, scenic areas, hilltops, and natural or man-made structures.
- # Pits containing oil, tank bottoms, other hydrocarbons, salt water, or any toxic substances will not be allowed in a floodplain.
- # Locate fluid containers on the upslope side of drilling pads whenever possible to facilitate early detection of leaks and spills – produced or drilling fluids could cause long-term damage to soils, ground water, and vegetation.
- # On slopes between 5 and 20 percent, surface disturbing activities will be scrutinized and conditions of approval may be applied to manage soils to maintain productivity, minimize erosion, and stabilize resources.
- # Occupancy or use of fragile or highly erosive soils will be considered on a case-by-case basis. On those soils that are on a slope greater than 5 percent, mitigation measures may be required (e.g., water bars, reseeding, pad design changes, etc.).

In constructing the site:

- # Construction must conform to the approved well site and layout plan in the Surface Use Plan of Operations (SUPO).
- # Limit tree and vegetation clearing to the minimum area required.
- # In areas of crucial habitat (grasslands, montane scrub, woodland/forest, and riparian/other wetlands/playas), new disturbance will be minimized to reduce loss or fragmentation of, and edge effect in the habitat (e.g., use of existing roads and utility corridors, minimization of cross-country placement of roads and utility corridors, pipelines, and other rights-of-way). Projects in areas of crucial habitat will be reviewed on a case-by-case basis for potential effects on crucial habitat. There will be the potential for other conditions of approval resulting from BLM review.

- # Feather and thin edges to reduce visual contrast in areas of visual sensitivity.
- # Time construction activities to avoid wet periods.
- # Regulate stream-side gravel borrow areas (refer to gravel source section below).
- # Surround reserve pits by BLM-standard four-strand barbed-wire fence.
- # An enclosed pit system or steel tanks may be required in some environmentally sensitive areas, flood areas, areas of shallow groundwater, and areas within 656 feet (200 meters) of a drainage. The drilling fluids, mud, and cuttings are stored in tanks and transported to approved offsite disposal areas.
- # Aboveground structures that are not subject to safety requirements should be painted to blend with the natural color of the landscape.
- # Ensure that development of the water source is consistent with water quality protection requirements.
- # More stringent noise abatement may be required in crucial wildlife habitats, in proximity to occupied locations, and developed recreation areas.
- # Powerlines shall be constructed to standards outlined in the most recent version of “Suggested Practices for Raptor Protection on Powerlines” published by the Edison Electric Institute/Raptor Research Foundation, unless otherwise agreed to by the Authorized Officer. The holder is responsible for demonstrating that power pole designs not meeting these standards are “raptor safe”. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modifications or additions to power line structures constructed under this authorization, should they be necessary to ensure the safety of large perching birds. The modifications and/or additions shall be made by the holder without liability or expense to the United States.
- # Operators are responsible for taking precautions to avoid igniting wildland fires and blowouts.

Pipeline Siting

- # Avoid locating pipeline routes adjacent to live watercourses or in proximity to steep hillsides to the extent practical to minimize the risk of petroleum spills and silt from construction entering streams.

- # Locate pipelines along existing linear facilities (other pipelines and roads) to the maximum extent practical. Minimize pipeline crossing of undisturbed areas.
- # Blading or clearing of the pipeline route may be authorized under the following definitions. Blading is the complete removal of brush and ground vegetation. Clearing is the removal of brush while leaving ground vegetation (grasses, forbs, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface. In areas where blading or clearing is allowed, the maximum width will not exceed that which is necessary for construction and maintenance of the line.
- # Vegetation, soil, and rocks left as a result of construction or maintenance activity shall be randomly scattered over the project area and shall not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer, except that an earthen berm shall be left over the ditch line to allow for settling back to grade.

Gravel Source

The temporary gravel source pit will be constructed so that runoff and sediment does not drain into streams. Depending on the local precipitation and other conditions, it may be advisable to install sediment traps or barriers (slash or straw bales) to ensure that runoff is adequately filtered. If needed, the location of the barriers would be determined by BLM. During reclamation, the gravel source pit will be regraded to meet preconstruction conditions and revegetated.

Noxious Weed Control

BLM will determine the size and density of the noxious weed infestations requiring implementation of a control program. Mechanical, chemical, biological, or other methods approved by BLM will be used to control infestations of noxious weed in disturbed areas. The operator must include provisions for noxious weed prevention and treatment in the SUPO. These may include removal of weed sources that could be picked up and transported by passing vehicles, limit seed transport into relatively weed-free areas, and/or retain shade to suppress weeds. Controls will be applied in the season or growth stage when most effective.

Pollution Control and Hazardous Substances Management

- # Ensure proper servicing and refueling of equipment to prevent surface and groundwater pollution.

- # Leaking equipment will be promptly repaired or removed from the site to prevent contamination from spills – any soil or water that has been contaminated will be placed in appropriate containers and removed from the site.
- # Spill prevention, control, and countermeasure plans are required.
- # Use of pesticides and herbicides shall comply with applicable Federal and State laws. Prior to use of pesticides, the BLM authorized officer will approve a plan for its use.
- # Storage tanks will have a berm constructed around them 24 inches high and of sufficient dimensions to contain the contents of the largest tank to serve as secondary containment should a spill occur.
- # The concentration of hazardous substances in the reserve pit at the time of pit backfilling must not exceed the standards set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).
- # All drilling-related CERCLA hazardous substances removed from the location and not reused at another drilling location must be disposed of in accordance with applicable Federal and State regulations.
- # All pits and tanks containing liquids or semi-liquids will be covered to prevent the entrapment or contamination of wildlife.

Drilling Operations

All proposed drilling operations and related surface-disturbing activities, as well as any change from an approved APD, must be approved before such activities are conducted. Approval occurs in accordance with (1) appropriate Onshore Oil and Gas Orders or Geothermal Resources Rule, (2) 43 CFR 3160, (3) Notices to Lessees, and (4) lease terms and conditions of approval.

Producing Operations

Portable and temporary facilities located on the drill pad are used to initiate the production from the reservoir. As drilling proceeds and reservoir limits are established, permanent production facilities are designed and installed. The type, size, and number of the facilities are determined by the number of producing wells, expected production rates, volumes of gas and water expected to be produced with the oil, and the number of separate leases involved. Any construction of new, permanent production facilities will conform with the best management practices described above and also must comply with the regulations (CFR), onshore orders, and applicable Notices to Lessees.

Additional considerations may arise from power systems that may be required for pumping (gas or electric) and generate noise; the siting and operation of facilities to separate water from oil, treatment and storage facilities; the need to dispose of wastewater that may be saline via evaporation pits or fluid injection.

Fluid minerals operations are subject to the applicable laws, regulations, lease terms and stipulations, orders, notices, and instructions of the BLM Authorized Officer. These include, but are not limited to, conducting operations in a manner that ensures the proper handling, measurement, disposition, and site security of leasehold production; protecting other natural resources, environmental quality, life, and property.

All production equipment installed on Federal leases will be constructed to prevent birds and bats from entering them and, to the extent practical, to discourage perching and nesting.

Reclamation and Abandonment

A reclamation plan will be part of the SUPO. Reclamation will be required for any surface disturbed that is not needed for continued well operations (producing and abandoned well sites). Additional reclamation measures may be required based on the conditions existing at the time of abandonment, and included as part of the conditions of approval of the Notice of Intent to Abandon.

- # Include provisions for noxious weed prevention and treatment.
- # Ensure proper disposal of debris.
- # Ensure reclamation is per surface owner's specifications/recommendations if applicable.

Well Site

- # All disturbed areas no longer needed for operations will be recontoured and revegetated.
- # Re-establish vegetation quickly on bare ground to minimize the potential for erosion and spread of noxious weeds.
- # A restoration plan for habitat of special status species will be developed in coordination with and approved by BLM.
- # All fill material sources will be relatively free of noxious weeds.
- # Restore habitat areas of special status species to pre-project conditions in accordance with the BLM-approved restoration plan. Timing for the completion of restoration work will be determined by the type of activities required and weather/climatic conditions.

- # Plug wells in a manner to prevent fluid migration and per State requirements.
- # Borrow pits and quarries will be restored.
- # Upon closure of the mud pits, bury all drilling products with at least 24 inches of cover, if material is available to ensure successful revegetation.
- # After abandonment and reclamation of a wellpad, a BLM-standard four-strand wire fence will be erected to exclude cattle for a minimum of two growing seasons.

Access Roads

- # When roads are abandoned, they will be ripped at least 16 inches deep, including turnouts; fill materials will be placed in cuts, and the abandoned road should be returned to its natural contour to the extent practical; then areas will be reseeded with a seed mix authorized by BLM.

APPENDIX A-IV REASONABLE FORESEEABLE DEVELOPMENT

INTRODUCTION

This appendix provides a summary of the exploration history, current lease status, and the 20-year projections for reasonable foreseeable development (RFD) in the Planning Area (Sierra and Otero Counties).

The Bureau of Land Management (BLM) Supplemental Program Guidance for planning for fluid mineral resources (BLM Manual Section [MS] 1624.2) identifies three factors of analysis that should be considered in making fluid minerals determinations in resource management plans or plan amendments. These are (1) the potential for fluid mineral occurrence and development, (2) impacts (including cumulative) of reasonably foreseeable development, and (3) the need for applying constraints or restrictions (stipulations) (BLM MS 1624.22).

The first factor, determining the potential for fluid minerals occurrence and development, is accomplished generally by identifying the major geologic trends, researching historical fluid minerals records (to the extent they are available), and predicting the resource capability and potential.

The next factor, RFD, is a projection of the fluid minerals actions and activities, including development, that are likely to occur in the Planning Area (Sierra and Otero Counties) over the life of Resource Management Plan Amendment (RMPA) (in this case, 20 years). The fluid minerals specialist focuses attention on projecting fluid minerals leasing, exploration, development, production, and abandonment activities likely to occur on land managed by the BLM and other Federal surface management agencies. This projection includes the number, density, type of wells likely to be drilled, and the surface use requirements (to project the amount of surface disturbance).

Once the projection of RFD is established, the interdisciplinary team is in a position to analyze the potential impacts of each alternative, the third factor. These impacts include direct, indirect, and cumulative impacts of the exploration, development, production, and abandonment activities projected to occur over the next 20 years.

EXPLORATION HISTORY

The oil and gas industry has been exploring in Sierra and Otero Counties since at least 1925 when the first well was drilled in Otero County (section 14, T. 23 S., R. 10 E., NMPM). Industry interest can be measured, in part, by evaluating the outward expression of that interest, which includes well drilling, seismic acquisition, and leasing activity.

To date, 98 wells have been drilled in Sierra and Otero Counties (35 and 63, respectively). A list of these wells is provided in Table A-2. Seventy-four of the 98 wells (76 percent) were drilled on Federal leases. Twenty-seven of all the wells drilled in the counties reported shows of oil and gas; 21 of these shows were on Federal lands. Additionally, 11 wells were reported in the Planning Area (nine of which were on Federal leases) as plugged and abandoned, typically indicating a test was run prior to abandonment but did not report shows. Four wells within the Planning Area were reported by industry scouts either to be gas wells or to have temporarily waited on production; three of the four have since been plugged. Table A-3 presents the oil and gas wildcat wells (those drilled in the area where there is no oil or gas production) by county. Table A-4 summarizes the location and potential of the four highly potential wells. It should be noted that industry indicates that, prior to 1960, any well flowing small to moderate amounts of natural gas or with good gas shows was considered insignificant because there was no market for the natural gas.

**TABLE A-2
INVENTORY OF PETROLEUM WELLS DRILLED IN SIERRA
AND OTERO COUNTIES, NEW MEXICO**

Section	Township	Range	Date Drilled	Lease Name	Total Depth	Status
14	10 S	6 W	1956	Allison #1	4,480	Temporarily abandoned, plugged and abandoned
27	10 S	1 W	1952	Victoria L&C #2	6,352	No oil or gas show at total depth, plugged and abandoned
25	10 S	1 W	1951	Victoria L&C #1	6,053	Recovered water from the perforations
22	11 S	9 E	1976	#1 Federal 'A-2'		Abandoned location
11	12 S	5 W	1950	Garner #1	6,524	Plugged and abandoned
7	12 S	4 W	1982	#1 W. Eleph. Butte Fed.	7,230	Dry and abandoned
3	12 S	4 W	1982	#2 W. Eleph. Butte Fed.	7,552	Dry and abandoned
8	12 S	4 W	1955	Brisler #1	8,585	Dry and abandoned
8	12 S	4 W	1951	#1 Drew Mathews	7,125	Dry and abandoned
35	12 S	1 W	1976	#1K Sierra St.	7,860	Dry and abandoned
10	12 S	9 E	1976	#2 Lewelling	9,487	Dry and abandoned
12	12 S	9 E	1976	#1 Lewelling	9,360	Temporarily abandoned, plugged and abandoned
12	12 S	9 E	1975	1 N.M. 'A' Federal		Abandon location
25	12 S	9 E	1974	#1 State Lease 2748	715	Dry and abandoned

**TABLE A-2
INVENTORY OF PETROLEUM WELLS DRILLED IN SIERRA
AND OTERO COUNTIES, NEW MEXICO**

Section	Township	Range	Date Drilled	Lease Name	Total Depth	Status
5	12 S	10 E	1975	#1 State L.G. '1453'	9,852	Dry and abandoned
2	13 S	4 W	1950	#1 Mimms	2,295	Dry and abandoned
2	13 S	4 W	1953	Mims #A-1	6,195	Temporarily abandoned
11	13 S	4 W	1948	#1 Mims	127	Abandon location
3	13 S	4 W	1982	#2 W. Eleph. Butte Fed.	7,556	Dry and abandoned
28	13 S	4 W	1947	#1 J. Scott	525	Plugged and abandoned
28	13 S	4 W	1947	Fred Bailey #1	625	Plugged and abandoned
28	13 S	4 W	1978	Fred Bailey #1-X		Abandon location
17	13 S	1 W	1965	#1 Leeman Field	7,346	Dry and abandoned
22	13 S	1E	1975	#3 Jornada del Muerto	2,320	Dry and abandoned
34	13 S	8E	1926	Tularosa Basin #1	3,965	Dry and abandoned
25	14 S	5 W	1940	Fee #1	2,100	Dry and abandoned
2	14 S	2 W	1944	Wofford #1	207	Dry and abandoned
7	14 S	2 W	1948	#1 Wofford	535	Dry and abandoned
8	14 S	2 W	1940	Graham #1	507	Plugged and abandoned
8	14 S	2 W	1949	Wofford #2	502	Dry and abandoned
18	14 S	2 W	1943	Winslow #1	587	Dry and abandoned
19	14 S	2 W	1926	McCall #1	2,910	Dry and abandoned
19	14 S	2 W	1947	State #1	700	Dry and abandoned
32	14 S	2 W	no date	#2	2,900	Dry and abandoned
17	14 S	1 W	1973	#1 Jornada del Muerto	9,800	Dry and abandoned
5	14 S	1 E	1974	#1 Beard Fed.	8,850	Dry and abandoned
13	14 S	1 E	1977	#5 Jornada del Muerto	830	Dry and abandoned
23	14 S	10 E	1970	#1 Houston	3,040	Dry and abandoned
24	14 S	10 E	1972	#1 Federal 'A'	3,690	Dry and abandoned
36	14 S	10 E	1974	#1 State 3724	4,579	Dry and abandoned

**TABLE A-2
INVENTORY OF PETROLEUM WELLS DRILLED IN SIERRA
AND OTERO COUNTIES, NEW MEXICO**

Section	Township	Range	Date Drilled	Lease Name	Total Depth	Status
7	14 S	11 E	1990	#1 Ysletano Canyon Fed	5,028	Gas well, waiting on pipe line, plugged and abandoned
20	14 S	11 E	1992	#1 Virden	4,991	Plugged and abandoned
2	15 S	3 W	1944	State #1	900	Dry and abandoned
32	15 S	3 W	1953	Gentry #1	5,418	Dry and abandoned
23	15 S	2 W	1982	#1 Federal '23'	2,630	Dry and abandoned
23	15 S	2 W	1959	N.M. - Fed #1	9,765	Dry and abandoned
2	15 S	1 E	1976	#4 Jornada del Meurto	2,105	Dry and abandoned
21	15 S	11 E	1962	#1 Walker	555	Dry and abandoned
20	16 S	1 E	1976	#1 Prisor Fed.	11,650	Dry and abandoned
21	16 S	2 E	1952	Guame #2	3,507	Plugged and abandoned
21	16 S	2 E	1950	Guame #1	2,202	Dry and abandoned
5	17 S	12 E	1952	Cloudcrof Unit #1	4,701	Dry and abandoned
10	18 S	8 E	1969	#1 Federal USA 'E'	7,785	Dry and abandoned
33	18 S	8 E	1970	#1 Fed G	7,660	Dry and abandoned
30	18 S	10 E	1970	#1 Fed F	8,288	Plugged and abandoned
35	18 S	14 E	1981	#1 Mesa Verde Ranch	7,011	Dry and abandoned
15	18 S	15 E	1983	#1 Dog Canyon 'YF' Fed	8,430	Plugged and abandoned, waiting on production test
18	20 S	9 E	1960	#1 Turquoise	5,436	Dry and abandoned
15	20 S	9 E	1954	Federal #1	7,585	Dry and abandoned
35	20 S	10 E	1954	Pearson #1	4,468	Dry and abandoned
14	20 S	14 E	1958	Federal 14 #1	5,043	Dry and abandoned
16	20 S	15 E	1963	#1 State 'Av'	4,027	Dry and abandoned
15	21 S	14 E	1953	Thorn Unit #1	4,646	Dry and abandoned
22	21 S	16 E	1962	#1 Federal	2,253	Dry and abandoned
18	21 S	18 E	1947	Scap Unit #1	2,664	Dry and abandoned

TABLE A-2
INVENTORY OF PETROLEUM WELLS DRILLED IN SIERRA
AND OTERO COUNTIES, NEW MEXICO

Section	Township	Range	Date Drilled	Lease Name	Total Depth	Status
2	21 S	20 E	1977	#1 Burro Canyon UT.	1,246	Junked and abandoned
2	21 S	20 E	1978	#1Y Burro Canyon UT	5,589	Dry and abandoned
5	22 S	10 E	1939	McGregor #1	1,730	Plugged and abandoned
34	22 S	13 E	1937	Everrett #1	3945-30	Plugged and abandoned
30	22 S	14 E	1960	#1 Hurley	2,433	Dry and abandoned
17	22 S	16 E	1960	#1 Leonard Fed	65	Plugged and abandoned
17	22 S	16 E	1961	#1 Federal		Abandon location
6	22 S	19 E	1972	#1 Little Dog-Fed	4,130	Dry and abandoned
14	23 S	10 E	1925	State #1	2,168	Dry and abandoned
7	23 S	15 E	1960	#1 Liberman State	2,695	Dry and abandoned
7	23 S	16 E	1960	#1 Spanel	2,682	Dry and abandoned
19	23 S	18 E	1960	#1 Warren	2,353	Dry and abandoned
9	23 S	19 E	1962	#1 Thompson	3,848	Dry and abandoned
27	23 S	19 E	1961	#1 McMillan	3,189	Dry and abandoned, shows
21	24 S	12 E	1956	Fed #1	1,775	Dry and abandoned
21	24 S	12 E	1958	Fed #1 old well drilled deeper	1,855	Dry and abandoned
22	24 S	12 E	1931	Evans #1	3,763	Dry and abandoned
29	24 S	12 E	1984	1 State '29'		Abandon location
9	24 S	14 E	1960	#1 A.N. Spanel	1,873	Dry and abandoned
28	24 S	15 E	1935	Donahue #1	1,692	Dry and abandoned
20	25 S	7 E	1930	Located Land #1	1,328	Plugged and abandoned
20	25 S	7 E	1939	Located Land #1	3,941	Old well drilled deeper, plugged and abandoned
11	25 S	8 E	1937	State #1	263	Dry and abandoned
23	25 S	8 E	1948	Maris State #1	986	Plugged and abandoned
23	25 S	8 E	1949	Maris State #1	731	Dry and abandoned

**TABLE A-2
INVENTORY OF PETROLEUM WELLS DRILLED IN SIERRA
AND OTERO COUNTIES, NEW MEXICO**

Section	Township	Range	Date Drilled	Lease Name	Total Depth	Status
23	25 S	8 E	1978	Marie #2	970	Plugged and abandoned
9	25 S	13 E	1946	McMillan #1	5,215	Plugged and abandoned
15	25 S	13 E	1978	#1 G.J. Ablah	5,305	Dry and abandoned
36	25 S	16 E	1959	#1 State	5,195	Dry and abandoned
28	25 S	17 E	1980	#1 Southland '28' State	2,970	Dry and abandoned
32	25 S	18 E	1980	#1 Southland St. '32'	3,635	Dry and abandoned
31	25 S	19 E	1970	#1 Alpha Fed	4,998	Dry and abandoned
18	25 S	20 E	1971	#1 W. Dog Canyon	4,570	Dry and abandoned
3	26 S	8 E	1949	#1 Wilmoth-Federal	206	Plugged and abandoned
18	26 S	11 E	1954	#1 Blanche Trigg-Federal	5,600	Dry and abandoned
17	26 S	11 E	1929	Wingo #1	450	Dry and abandoned
14	26 S	12 E	1997	#1 Bennett	2,643	Junked and abandoned, lost hole
14	26 S	12 E	1997	#1Y Bennett Ranch	7,100	Gas well
5	26 S	16 E	1942	McMillan-Turner	2,175	Dry and abandoned
3	26 S	17 E	1980	1 Southland "2" State		Abandon location
14	26 S	20 E	1959	#1 Spiegel-Fed.	4,578	Plugged and abandoned

SOURCE: Petroleum Information scout tickets and Dwight's scout reports

**TABLE A-3
OIL AND GAS WILDCAT WELLS BY COUNTY**

County	Number of Wells	Number of Shows	Wells on Federal Mineral Estate
Otero	63	17	44
Sierra	35	10	30
Total	98	27	74

SOURCE: Petroleum information scout tickets and Dwight's scout reports

Geophysical exploration increased significantly between 1978 and the mid 1980s due primarily to the oil embargo and resulting increase in the price of oil and gas. It should be noted that drilling of exploration wells in the Planning Area does not appear to correlate with the price of oil and/or gas.

**TABLE A-4
SUMMARY OF HIGHLY POTENTIAL WELLS**

Well	Location	Date Drilled	Scout Report
Summit Mims #A-1 (non-Federal lease)	T. 13S., R. 4W., Section 2, NMPM Engle Basin Sierra County	1953	Temporarily abandoned, completed in limestone (probably Penn) gas to surface in 9 minutes, 250 thousand cubic feet per day (MCFD) on drill string test, water from perforations.
Houston Oil #1 Lewelling (Federal lease)	T. 12 S., R. 9 E., Section 12, NMPM Tularosa Basin Otero County	1976	Temporarily abandoned, perforated Pennsylvanian, flowed 138 MCFD. Wolfcamp formation was tested at 168 MCFD through perforations at 5,140 to 5,170 feet.
Cibola #1 Ysletano Canyon (Federal lease)	T. 14 S., R. 9 E., Section 12, NMPM Tularosa Basin Otero County	1990	Gas well; perforated Atoka-Morrow, flowing 300 MCFD on 2-inch choke, no oil.
Harvey Yates #1Y Bennett Ranch (Federal lease)	T. 26 S., R. 12 E., Section 14, NMPM Tularosa Basin Otero County	1997	Perforated Upper Mississippian/Helms Calculated absolute open flow 3,615 MCFD, flow 4,400 MCFD after cleanup

SOURCE: Petroleum information scout tickets and Dwight's scout reports.

Seismic vendors offer 2-D (two-dimensional) seismic in both Sierra and Otero Counties. These data are publicly available and were acquired in the 1970s and 1980s. The Otero Platform and Salt Graben Basin recently have seen an increase in geophysical activity, which can be correlated to the recent discovery in 1997. These data primarily are being acquired privately although a large (55 sections) 3-D (three-dimensional) survey in the Salt Basin (Crow Flats 3-D Seismic Project) is a group shoot and was completed in February 2000. The new surveys are both 2-D and 3-D. The 3-D surveys are acquired at a higher density than 2-D surveys and therefore are more expensive. 3-D surveys tend to be used to delineate prospective areas rather than as exploratory tools in frontier areas. A speculative regional survey also has been discussed as a possible survey in the Otero Platform area. The new geophysical activity as well as the increased interest in leasing indicates an active industry interest in the areas.

Existing geothermal wells in the Planning Area are located in Truth or Consequences, an area long known for its traditional hot baths and springs. Local Truth or Consequences motels use the resource for space and swimming pool heating. Additionally, a number of small businesses and public entities have used the geothermal waters for space heating, thermal baths, and swimming pools. Hatton (1978) indicated that several buildings in the city have been heated geothermally for many years. Two examples include the Truth or Consequences Senior Citizens' Center and the Carrie Tingley Hospital demonstration projects (Starkey and Icerman 1983).

Geothermal exploration in the Planning Area appears to be associated primarily with the military and New Mexico State University's (NMSU) efforts to locate geothermal resources. Exploration to date indicates that the geothermal resources are low temperature (generally less than 194° Fahrenheit (90° Celsius) and, therefore, would require a direct end use such as alternative space heating rather than electrical power generation. The price of natural gas also drives the exploration for geothermal resources; the higher the price of heating (due to the price of natural gas), the higher the incentive for alternative heat sources. Industries in southern New Mexico that have demonstrated the use of low-temperature geothermal resources include green houses and aquaculture as well as building space and pool heating.

CURRENT LEASE STATUS

Table A-5 shows the total number of leases and lease acreage by county within Sierra and Otero Counties as of January 1, 1999.

**TABLE A-5
EXISTING FLUID MINERAL LEASES**

County	Oil and Gas		Geothermal	
	Number of Leases	Acres	Number of Leases	Acres
Otero	61	102,939.09 ^a	0	0
Sierra	0	0	0	0
Total	61	102,939.09	0	0

SOURCE: Bureau of Land Management 1999

NOTE: ^a973.42 acres questionable (one lease established in 1979 should be expired); however, BLM records indicate that those acres still are authorized and not closed.

TWENTY-YEAR DEVELOPMENT PROJECTIONS

Oil and Gas

Current impact analysis policy regarding RFD of fluid mineral resource requires that a minimum discovery must be assumed in “frontier” areas for the purpose of impact analysis. With the recent discovery (1997) of the gas well in Otero County, interest in the Planning Area has increased ten-fold based on lease nomination requests and new geophysical permitting activity.

BLM’s Manual 1624-1, which provides guidance on how to develop an RFD, states that

“...projections should be based on past and present leasing, exploration, and development activity as well as professional judgment on geological and technological and economic factors. Extrapolations of historical drilling and/or production activity may be used as the basis for projections.”

Using the past 72 years of drilling activity to determine the average rate of wildcat drilling, approximately 1.4 wells per year are drilled in the Planning Area with one well per year drilled on Federal leases. Given a planning period of 20 years, one might assume 28 wells drilled in the Planning Area of which 20 would be on Federal minerals. It should be noted that this Federal lease wildcat RFD is based on statistics with no regard to surface management (i.e., military, Forest Service, or Indian lands). However, only one previous well drilled on Federal lands was drilled in an area that would be open for leasing under other Federal surface management (this well was located within the boundaries of the Lincoln National Forest). Therefore, the assumption that all wells drilled on Federal lands would be under the surface jurisdiction of the BLM is appropriate.

Another possible development scenario would be to assume that the next 20 years would be similar to the most active 20-year period for each county. Again, using the past 72 years to base the statistics, the most active 20-year period for the Planning Area was from 1940 to 1960, with 38 wells drilled (27 on Federal minerals). However, the most active period for Federal minerals in the entire Planning Area was from 1960 to 1980, with 30 wells drilled on Federal minerals (37 wells total drilled). By county, the most active drilling period was 17 Federal wells out of a total of 22 wells drilled in Sierra County from 1940 to 1960, and 22 Federal wells out of a total of 29 wells drilled in Otero County from 1960 to 1980. Therefore, a potential wildcat RFD could be as little as 27 wells to 39 (17 + 22) wells drilled on Federal minerals. Due to the recent discovery on the Otero Platform, the RFD for the next 20 years assumes that the greatest number (39) of exploration wells (wildcats) will be drilled. According to the Chevron web page,

“In the petroleum industry, the average U.S. wildcat well (an exploratory well drilled a mile or more from existing production) has a one in 10 chance of striking hydrocarbons. A rank wildcat well, drilled in an unproven, frontier area, stands a one in 40 chance. Thus, although today’s prospectors have better tools than their ancient counterparts,

good luck still is a factor in the search for petroleum.”

<http://www.chevron.com/explore/index.html>

Using the wildcat success ratio for frontier areas of 1 in 40 wells (2.5 percent) (Chevron 1998), only one of these wells is likely to initiate a development situation of offset wells (called appraisal wells). However, with the new discovery in Otero County, BLM on the advice of industry is assuming a higher success ratio on the Otero Platform, especially given the active interest in the area, such as 3-D seismic exploration. Three wildcat wells will be assumed in the RFD to have a sufficient shows of hydrocarbons that additional wells will be drilled to “appraise” the “discovery” or successful wildcat.

Four appraisal wells have been requested for the 1997 discovery well of the Bennett Ranch Unit; therefore, four wells per appraisal program have been assumed for the RFD. This is consistent with offsetting the discovery well in four directions to delineate the potential structure that might be trapping the hydrocarbons.

In the RFD, it is assumed that three fields will be developed from the Bennett Ranch Unit and/or the three RFD appraisal scenarios. Based on the Bennett Ranch discovery, it is assumed that these fields will be gas production; however, the potential for multiple pay zones and oil production also appears to be possible. It is likely that gas production from up to approximately 12 gas wells in one field would be needed to support the cost of bringing in the infrastructure to a field located in southern Otero County (Ron Broadhead, New Mexico Bureau of Mines and Mineral Resources, personal communication, 1998). The production and potentially the resulting field size (number of wells) may need to be greater in other parts of the Planning Area due to the distance required to connect to existing gas pipelines. Therefore, additional wells will be drilled during development of the field. The RFD assumes up to 10 additional wells per field with at least 12 out of the 15 drilled wells per field producing gas (three wells are assumed to be noneconomic and will be plugged and abandoned within three years of drilling). Given the shows (refer to Table A-2) and industry’s indication for the potential for oil, each field developed in the RFD also is assumed to have an oil field developed on 40-acre spacing located within the gas field. The discovery and/or appraisal for the oil field is assumed to have been conducted by the gas wells, but none of the gas wells are assumed to produce oil. Therefore, the RFD assumes that 20 additional wells per field will be drilled to develop the oil pool and that 16 of these wells per field will produce oil (four of the wells are assumed to be noneconomic and will be plugged and abandoned). It is assumed that the oil will be trucked from the area rather than conveyed via pipeline. The oil may be stored at the wellhead or collected at a central location (bulk oil storage facility). A bulk oil storage facility will be assumed for each oil field. The oil wells may or may not produce formation water from the beginning but are assumed to produce water at some point during their production until abandonment (20 to 30 years). Gas wells also are assumed to produce formation water in their later years prior to abandonment (12 to 15 years). Therefore, one underground injection control (UIC) well is assumed to be permitted and drilled for each field. The production facilities (gas compression station

and/or gas plant, bulk oil storage and transfer station, and UIC well) could occupy the same location and the surface acreage disturbed would probably be less than 15 acres; however, for the RFD it is assumed that each facility is separate.

The RFD includes the following:

- # 5,000 miles of geophysical seismic activity (average of 250 miles per year); most of the lines would be acquired using vibroseis. Seismic surveys in areas with difficult terrain probably will be acquired using portable drilling rigs and buried dynamic charges.
- # 39 frontier wildcat wells would be drilled; three would have an appreciable show resulting in the each well being offset by four appraisal wildcats (total of 12 appraisal wells).
- # Three gas fields likely would be developed on 320-acre spacing per NMOCD Rule 104 and nearby gas fields (areal size of the field approximately 6 square miles), resulting in 12 production wells per field. Ten additional development wells per field would be drilled with the assumption that three wells of the total number of wells in a field (discovery, appraisal, and development) would be noneconomic and the impact will be short term. (Total of 30 additional wells drilled)
- # Each gas field would contain an oil field developed on 40-acre spacing per NMOCD Rule 104 (areal size approximately 1 square mile), resulting in 16 production wells per field. 20 additional wells drilled per field with the assumption that four wells of these wells would be noneconomic and the impact would be short term and the others are the producing wells.
- # Typical life of a producing well is 10 to 12 years of gas production and 30 years for oil operation; therefore, three to five gas production wells may be plugged during the planning period.
- # Approximately 100 miles of transmission pipeline would be needed to transport the gas out of the Planning Area to market (assuming three pipelines with a Planning Area average distance).
- # A compression/gas plant facility would be developed as part of each field's infrastructure (total of three).
- # Bulk oil storage facility would be developed as part of each field (total of three) .
- # Three underground injection control wells would be permitted and installed to dispose the produced water (assuming one well per field and the fields not sharing a disposal well); these

facilities are estimated based on the assumption that enough water would be produced in the field that off-site disposal would be required. This assumption may be overly conservative if the fields are gas or water production can be disposed on site via direct discharge over the next 20 years.

Table A-6 summarizes the oil and gas development over the next 20 years.

**TABLE A-6
TWENTY-YEAR PROJECTION FOR OIL AND GAS DEVELOPMENT^a**

Type of Action	Number of Actions on Federal Lands	Area Disturbed ^b	Approximate Total Acres Disturbed	
			Short Term	Long Term
Geophysical (miles)	5,000	On existing roads and trails and off-road (1 acre/mile)	5,000	Minimal
Frontier Wildcat Wells	39	Drill pads and access road	351 ^c	101.4 ^d
Appraisal gas wells (offsetting wildcat wells)	12	Drill pads, access road, pipelines, and power lines	108 ^e	60 ^f
Gas development wells	30	Drill pads, access road, pipelines, and power lines	228.6 ^e	126.6 ^f
Oil development wells	60	Drill pads, access road, and power lines	484.8 ^e	268.8 ^h
Gas production facilities	3	5 acres/site	15	15
Gas transmission pipeline (miles)	100	3.6 acres initial disturbance per mile, 2.6 acres stabilized per mile	360 ⁱ	260 ⁱ
Bulk oil storage facility	3	5 acres/site	15 ^j	15 ^j
UIC well	3	Drill pads, access road, and power lines	27 ^k	15 ^k
Total Acres Disturbed			6,589.4	861.8

NOTES:

- a Not County-specific
- b Acreage estimates for each component from observed average disturbance in the Roswell/Carlsbad area as provided in Bureau of Land Management 1994 Appendix 18 unless otherwise noted.
- c Wildcat well - assume 6 acres (400 by 600 feet [122 meters by 183 meters]) for drill pad (including worker camp) and 3 acres per access road = 9 acres. The source of this assumption is recent drill pad requests from the Bennett Ranch Operators and assumptions based on historical data made in the Roswell/Carlsbad Resource Areas of the BLM (1994).

- d 2.4 acres per well not reclaimed immediately for all but three of the rank wildcats. Three of the wildcats are assumed to develop into production wells, which result in 5 acres per well not reclaimed immediately.
- e Appraisal and development gas wells - assume 4.4 acres drill pad and access road for all wells, 4.6 acres for associated pipelines and power lines for all producing wells, which are assumed to be economic (all appraisal wells and seven development wells per field). If a worker camp is needed, it is assumed that the one set up for the wildcat well can be used.
- f Production gas wells - 5 acres per producing well will not be reclaimed immediately. For the three wells per field that are assumed to be drilled but not economic, 2.4 acres per well are assumed not to be reclaimed within a three-year period after initial disturbance.
- g Development oil wells - assume 4.4 acres drill pad and access road for all wells (20 wells per field), 4.6 acres for associated pipelines and power lines for only producing wells which are assumed to be economic (16 producing wells per field). If a worker camp is needed, it is assumed that the one set up for the wildcat well can be used.
- h Production oil wells - 5 acres per well not reclaimed immediately. For the three wells per field that are assumed to be drilled but not economic, 2.4 acres per well are assumed not to be reclaimed within a three-year period after initial disturbance.
- i Gas transmission pipelines 3.6 acres per mile (30 feet [9 meters] wide) and reclaim to approximately 2.6 acres (8 to 9 feet [2.4 to 2.7 meters] wide).
- j This facility could occupy the same acreage as the gas production facility or the UIC facility though the acreage for those facilities would increase. Therefore, for the purpose of estimating surface disturbance, all facilities are assumed to be separate.
- k UIC wells – assume a similar amount of acreage for drilling the well and constructing the facility as a production well (9 acres per well). Assume each well is reclaimed to 5 acres per well for long-term impacts.

Geothermal Resources

The production of geothermal resources for direct-use purposes could increase over the next 20 years. Space and pool heating is well known in the Truth or Consequences area, although expansion in the Truth or Consequences area would be primarily on private land. NMSU is promoting geothermal use and provides entrepreneurs with advice and facilities for potential new ventures. Greenhouses for roses and other flowers and plants as well as fish farms are potential direct uses of the resource. There are currently three commercial greenhouses in Dona Ana County south of Sierra County; two using Federal geothermal resources. Expected development within the Planning Area would be in Sierra County. Most of the identified geothermal potential in Otero County is in military withdrawn land.

Development in the next 20 years is expected to be on a small scale. Over the planning period, two temperature surveys of 30 wells each would be drilled. These drill sites would be located adjacent to existing roads and each site would disturb an area 25 feet by 25 feet (7.5 meters by 7.5 meters). Five other various kinds of geophysical exploration permits (gravity, electrical, resistivity, and radon for instance) would be approved. Most of these activities would be conducted along existing roads and trails and would involve minimal surface disturbance.

Four test wells would be drilled. Each test well would disturb an area of 1 acre and require an access road 1.5 miles long by 16 feet (4.8 meters) wide. Only one of the four test wells will be assumed to become a commercial greenhouse facility. The facility would require an area of 10 acres for development and two production wells (the original test well and another well). Wastewater either would be reinjected or pumped into evaporation pits. Table A-7 summarizes geothermal development over the next 20 years.

**TABLE A-7
20-YEAR PROJECTION FOR GEOTHERMAL DEVELOPMENT**

Type of Action	Number of Actions on Federal Lands	Area Disturbed	Total Acres Disturbed
Geophysical permit	5	Primarily on existing roads and trails	Minimal
Temperature-gradient surveys	2	30 drill pads (0.01 acres)	0.6
Test wells and access roads	4	Drill pads (1 acre/pad) and access road (3 acres/well)	16
Production facilities	1	10 acres/sites (2 wells)	10
Total Acres Disturbed			26.6

APPENDIX A-V PLAN ALTERNATIVES CONSIDERED

INTRODUCTION

Prior to offering lands for lease, the New Mexico State Office Adjudication Staff reviews the records to identify what lands are available for leasing and whether stipulations need to be attached to the lease form.

Determining the availability of land and the need for either continuing existing management or imposing constraints on fluid minerals activities is accomplished through a programmatic level of resource planning and National Environmental Policy Act (NEPA) analysis; in this case, the Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS). The results of the analysis are used to clarify Bureau of Land Management's (BLM's) intent, in advance, of the need to protect certain resources and resource values. The primary benefit is that NEPA analysis and legal compliance are greatly streamlined for future undertakings (e.g., leasing, Application for Permit to Drill [APD], etc.).

This appendix provides the information regarding the stipulations resulting from this programmatic analysis. Once approved, this along with other management information in the RMPA/EIS will provide the guidelines on how fluid minerals activities will be managed on public land and privately owned lands overlying Federal fluid minerals in Sierra and Otero Counties.

AVAILABILITY OF LANDS

Generally, Federal lands are managed as either closed to leasing or open for leasing with or without stipulations. An explanation of these follows.

Closed to Leasing

Public land may be affected by nondiscretionary and discretionary closures, which are presented in a lease as stipulations. These areas are determined to be unsuitable for leasing and development because of unique, highly valued, complex, or legally protected resources; conflicting land uses; or because they pose substantial hazards to exploration, development, and production.

Nondiscretionary closures include those lands that must be closed to leasing for reasons beyond the discretion of the BLM. These are lands specially precluded from fluid minerals leasing by law, regulations, Secretarial or Executive Order, or that have been otherwise formally closed by decisions reached beyond the scope of the BLM. Examples of nondiscretionary closures in the Planning Area include the White Sands Military Range and other military installations; White Sands National Monument and other National Park Service land; towns, villages, and incorporated cities. Within BLM's Decision Area, examples of nondiscretionary closures include public water reserves and Wilderness Study Areas.

Discretionary closures include those lands where the BLM has determined that fluid minerals leasing, even with the most restrictive stipulations, would not adequately protect other resources, values, or land uses. Examples of discretionary closures in BLM's Decision Area are the Areas of Critical Environmental Concern (ACECs).

Open to Leasing

As mentioned above, lands open to leasing are open with stipulations or open with standard lease terms and conditions as described below.

Open to Leasing with Standard Terms and Conditions

Areas may be open to leasing with no specific management decisions defined in a Resource Management Plan (RMP). However, these areas are subject to the lease terms and conditions as defined on the lease form (Form 3100-11, Offer to Lease and Lease for Oil and Gas; and Form 3200-24, Offer to Lease and Lease for Geothermal Resources; copies at the end of Appendix A-II). The forms include lease terms and conditions, which cover subjects such as bonding, rentals, royalties, inspections, and safety. Of particular interest here is Section 6, Conduct of Operations, of the lease form, which establishes the general and reasonable requirements for the protection of surface resources and is referred to as "standard lease terms and conditions." Standard lease terms and conditions may not require the lessee to relocate drilling rigs or supporting facilities by more than 656 feet (200 meters), require that operations be sited off the leasehold, or prohibit new surface-disturbing operations for more than 60 days (43 CFR 3101.I-2). Section 6 also provides authority for interim and final reclamation measures to minimize adverse environmental impacts.

In addition, the standard lease terms and conditions specifically require that the lessee contact the lessor prior to disturbing the surface. They also specify that the lessee may be required to complete inventories or special studies in accordance with NEPA and compliance with the Endangered Species

Act of 1973, National Historic Preservation Act of 1966, and other applicable laws (refer to Appendix A-I).

Open to Leasing with Stipulations

Constraints in the form of stipulations are conditions included in a lease when environmental and planning analyses have demonstrated that additional and more stringent environmental protection is needed. Stipulations are provisions that modify the standard lease rights and are attached and made part of the lease.

It is BLM policy that the use of stipulations should be considered appropriate only when they are both necessary and justifiable. A stipulation is justifiable if there are resources, values, or users present that (1) cannot coexist with fluid minerals operations, or (2) cannot be adequately managed or accommodated on other lands for the duration of the operation, and (3) would provide greater benefits to the public than those of fluid minerals operations.

Waivers, exceptions, and modifications to existing lease stipulations can be granted if circumstances or relative resource values change or if the lessee demonstrates that operations can be conducted without causing unacceptable impacts. A waiver is a one-time exemption to a lease stipulation (i.e., the stipulation no longer applies anywhere in the leasehold). An exception is a one-time exemption to a lease stipulation, which is determined on a case-by-case basis (the stipulation would continue to apply to all other sites within the leasehold to which restrictive criteria apply). A modification is a change to the provisions of a lease stipulation, either temporary or for the term of the lease. If the Authorized Officer determines, prior to lease issuance, that a stipulation involves an issue of major concern, modification or waiver of the stipulation is subject to public review (43 CFR 3101.1-4).

Lands currently under lease will not be affected by the stipulations identified in this RMPA. New leases will be required to adhere to the stipulations as identified in the RMPA upon completion of the RMPA.

The three types of lease stipulations are no surface occupancy, controlled surface use, and timing limitation, as described below.

- # No Surface Occupancy—A stipulation of no surface occupancy (NSO) is intended for use only when other stipulations are determined to be insufficient to adequately protect the public interest. As implied, the surface of a given area cannot be occupied. The surface areas are determined to be unsuitable because of unique, highly valued, complex, or legally protected resources; significant potential conflict with current or planned land use; and/or areas posing

hazards to fluid minerals activities. Generally, NSO is considered feasible only for areas that could be directionally drilled. Examples of NSO include Recreation and Public Purpose Leases and Patents and Ecological Study Plots.

- # Controlled Surface Use—A stipulation of controlled surface use (CSU) is intended to be used when lease occupancy and use generally are allowed on all portions of the lease year-round, but because of special values, or resource concerns, specific lease activities require strict control. CSU is used to identify constraints on surface use or operations that may otherwise exceed the mitigation provided by Section 6 of the standard lease terms and conditions and the regulations and operating orders. CSU is less restrictive than stipulations of NSO or timing limitation, which prohibit all occupancy and use on all or portions of a lease for all or portions of a year. The use of CSU should be limited to areas where restrictions are necessary for specific types of activities rather than all activity. An example of CSU is to limit certain activities in the vicinity of a sensitive resource (e.g., avoidance of potential nest sites).

- # Timing Limitation—A stipulation of timing limitation (TL) (often called seasonal) prohibits fluid minerals activities for a specific period of time less than one year. This type of stipulation is intended to limit activities to time periods that lessen the impact on resources or land uses to provide additional protection in areas that may have important seasonal use. Examples of TL include (1) allowing no drilling during a nesting season, and (2) evacuating the White Sands Missile Range Safety Evacuation Zone prior to and during missile firings.

As explained in Section 2.3 of Chapter 2, three alternatives were examined: No-action Alternative, Alternative A, and Alternative B. Table A-8, which follows, summarizes the management direction by resource concern for each alternative. Table A-8, similar to Table 2-9 in Chapter 2, provides more descriptive information about the resource concerns than does the abbreviated Table 2-9.

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Lands and Access				
White Sands Missile Range Safety Evacuation Zone (Map 3-2)	These lands shall be evacuated on days that missiles are to be fired. Memorandum of Understanding between Department of the Army and Department of the Interior, January 1960. Existing management imposes a timing limitation (RMP Decision OGG-1); approximately 311,410 acres.	Timing limitation	Timing limitation	Timing limitation
Old Air Force bombing and gunnery range (Map 3-2)	Subsurface use of lands used as impact areas of the old Air Force bombing and gunnery range is prohibited (PLO 2569); approximately 8,264 acres (Ts. 23, 24 S., Rs. 16, 17, 18 E; NMPM). No action has been taken to remove the restriction (RMP Decision L-2). Leasing is precluded in these areas. Surface use only is allowed until such time as the restriction is removed.	Nondiscretionary closure; subsurface closed until such time as the restriction is removed	Nondiscretionary closure; subsurface closed until such time as the restriction is removed	Nondiscretionary closure; subsurface closed until such time as the restriction is removed
Caballo Mountain Communication Site (Map 3-2)	Existing management imposes no surface occupancy in SW 1/4, section 26, T. 15 S., R. 4 W., NMPM (RMP Decision OGG-3); approximately 161 acres. The site recently has been surveyed for its accurate geographical location. Development has expanded south into the NE 1/4 of section 35.	No surface occupancy	Standard lease terms and conditions (must protect capital investments)	Standard lease terms and conditions (must protect capital investments)

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Recreation and Public Purpose (R&PP) Leases and Patents (various locations)	Under the Recreation and Public Purpose (R&PP) Act, BLM has the authority to lease or patent land to governmental and nonprofit entities for public parks, building sites, or other public purposes. Existing management imposes no surface occupancy (unless waived) to protect R&PP facilities (RMP Decision OGG-10). Approximately 1,799 acres.	No surface occupancy (unless waived)	No surface occupancy (unless waived)	No surface occupancy (unless waived)
Public Water Reserves (about 40 acres each, various locations)	Closed to leasing by Executive Order (EO) (PWR 107, 1926); approximately 693 acres total.	Nondiscretionary closure	Nondiscretionary closure	Nondiscretionary closure
Community Pit 7 (Map 3-2)	Public land generally is open to mineral entry and development except for specific areas withdrawn from mineral location (LM-1); approximately 30 acres (Section 9, T. 20 S., R. 09 E., NMPM). Locatable mineral activities are regulated by BLM to prevent unnecessary or undue degradation of the land.	Standard lease terms and conditions	No surface occupancy	No surface occupancy
Air navigation site	Secretarial Order 125; approximately 117 acres (Sections 17 and 18, T. 13 S., R. 01 W., NMPM).	Nondiscretionary closure	Nondiscretionary closure	Nondiscretionary closure
Berrendo Administrative Camp Site	BLM administrative site; approximately 40 acres (Section 9, T. 23 S., R. 15 E., NMPM).	Standard lease terms and conditions	Controlled surface use (avoid structures and helipad to protect capital investment)	Controlled surface use (avoid structures and helipad to protect capital investment)

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Watersheds and Water Resources				
Highly erosive or fragile soils: Nickel-Bluepoint Alamogordo-Gypsum Land-Aztec Prelo-Tome-Largo Holloman-Gypsum Land-Yesum (Map 3-5)	General management guidelines are to manage soils to maintain productivity and minimize erosion and stabilize the resources. Management activities in areas of high erosion potential will be designed to minimize surface disturbance to the extent possible. Approximately 1,050,348 acres in the Planning Area and 310,367 acres BLM's Decision Area.	Standard lease terms and conditions	Controlled surface use	Controlled surface use
Riparian/ Wetlands/Playas (Map 3-7)	Objective is to avoid impacts on wetlands in compliance with Section 404 of the Clean Water Act, and to riparian habitats in accordance with BLM guidelines.	Standard lease terms and conditions	No surface occupancy within 0.25 mile (400 meters)	No surface occupancy within 0.5 mile (804 meters)

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Watershed Areas Area (Map 3-5)	<p>Limited ORV use on approximately to protect watershed values</p> <ul style="list-style-type: none"> # Wind and Chess Draw (Cornudas Mountains) Watershed Area, approximately 34,499 acres (RMP Decisions W-1 and VR-3) (Ts. 25, 26 S., Rs. 13-16 E., NMPM). Note: within this area, the Cornudas, Alamo, and Wind Mountains have all been designated as ACECs, and are closed to leasing. # Moccasin and Otto Draw (southwest of Piñon) Watershed, approximately 13,662 acres (RMP Decision W-2) (Ts. 20, 21 S., Rs. 14, 15 E., NMPM). # Watershed area east of Tularosa and south of Tularosa River, approximately 17,046 acres (RMP Decision W-3) (Ts. 14, 15, S., Rs. 09, 10 E., NMPM). # Three Rivers (north of Tularosa) Watershed, approximately 12,741 acres (RMP Decision W-4) (T. 11 S., Rs. 09, 9½ E., NMPM). # Watershed area east of Crow Flats, approximately 14,890 acres (RMP Decision W-5) (Ts. 24, 25, 26 S., Rs. 18, 19 E., NMPM). 	Standard lease terms and conditions	Controlled surface use	Discretionary closure (and no geophysical exploration allowed)

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Vegetation				
Ecological Study Plots (Map 3-7)	<p>Existing management imposes no surface occupancy</p> <ul style="list-style-type: none"> # Engle Ecological Study Plot, approximately 40 acres (RMP Decision OGG-4, Public Land Order 4038), (Section 35, T. 13. S., R. 02 W., NMPM) # Cuchillo Ecological Study Plot, approximately 1,471 acres (RMP Decision OGG-4, Public Land Order 4038). (Sections 10, 11, 14, T. 12 S., R. 05 W., NMPM) # Nordstrom Ecological Study Plot, approximately 1,391 acres (RMP Decision OGG-4, Public Land Order 4038), (Sections 27, 28, 33, 34, 35, T. 16 S., R. 05 W., NMPM) # Trujillo Ecological Study Plot, approximately 39 acres (RMP Decision OGG-4, Public Land Order 4038), (Section 3, T. 12 S., R. 06 W., NMPM) # Danley Ecological Study Plot, approximately 179 acres (RMP Decision OGG-4, Public Land Order 4038), (Section 18, T. 13 S., R. 09 E., NMPM) # Lee Ecological Study Plot, approximately 40 acres (RMP Decision OGG-4, Public Land Order 4038), (Section 21, T. 23 S., R. 13 E., NMPM) 	No surface occupancy	No surface occupancy	No surface occupancy

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Wildlife and Special Status Species				
Big Game Habitat Areas (Map 3-7)	<p>Objective is to provide adequate habitat for big game.</p> <p># Otero Mesa Habitat Area (pronghorn, desert grasslands habitat), approximately 427,275 acres (RMP Decision WL-4) (Ts. 21-26 S., Rs. 10-16 E., NMPM)</p> <p># Nutt and White Sands Antelope Areas (Jornada Plain), approximately 529,559 total acres (RMP Decision WL-8), (Nutt Antelope Area is T. 19 S., Rs. 07, 06 W., NMPM, 75,850 acres; White Sands Antelope Area is Ts. 10-17 S., Rs. 01-04 W. and 01, 02 E., NMPM, approximately 453,709 acres).</p> <p># Caballo Mountains Deer Habitat Area, approximately 93,179 acres (RMP Decision WL-5), (Ts. 14-17 S., Rs. 03, 04 W., NMPM)</p> <p># Sacramento Escarpment Deer Habitat Area, approximately 170,275 acres (RMP Decision WL-6), (Ts. 11-15 and 17, 18 S., Rs. 08-10 E., NMPM). The southern portion of this area coincides with the Sacramento Escarpment ACEC.</p>	Standard lease terms and conditions	Controlled surface use	Controlled surface use

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Crucial habitats: grasslands, montane scrub, and woodland/forest (Map 3-7)	In crucial habitats, habitat fragmentation has many negative effects on biota: loss of total habitat area, creation of smaller, more isolated habitat patches, changes in landscape matrix, increases in disturbance - adapted (weedy) and exotic species, and increased susceptibility to random environmental change (e.g., climatic variation). These factors operate in a series of feedback loops that affect population structure and the genetic health of the various species. Approximately 729,457 acres total.	Standard lease terms and conditions	Standard lease terms and conditions	Standard lease terms and conditions
Otero Mesa and Nutt desert grassland habitat areas	Purpose is to protect portions of the remaining grassland community by minimizing habitat fragmentation. Approximately 132,471 acres (Otero Mesa area is 116,206 acres and Nutt area is 16,265).	Standard lease terms and conditions	No surface occupancy	No surface occupancy
Special Status Species (Map 3-8)	Federally listed threatened and endangered species, species proposed for Federal listing, Federal candidates, BLM sensitive species, and State-listed species. All exploration and development activities will follow current requirements of Section 7 of the Endangered Species Act for Federally listed and proposed species, and current BLM policy for management of State-listed and BLM sensitive species.	Standard lease terms and conditions	Controlled surface use	Discretionary closure on occupied or essential habitat

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Bighorn sheep	Sites with suitable habitat parameters for bighorn sheep are located in the Caballo, Sacramento, Guadalupe, Brokeoff, and Cornudas Mountains. Approximately 199,020 acres total. The Caballo Mountains provide a potential movement corridor for bighorn sheep from Fra Cristobal Mountains.	Standard lease terms and conditions	Controlled surface use and timing limitation	Controlled surface use and timing limitation
Percha Creek Riparian Habitat Area (Map 3-8)	Purpose is to improve and protect the riparian area along Percha Creek for wildlife habitat (mainly for Federally endangered southwest willow flycatcher), watershed values, recreation, and visual quality. Currently part of a 940-acre area nominated as an ACEC. Existing management (RMP Decisions WL-2 and R-4) limits ORV use on approximately 276 acres to existing roads and trails (<i>Federal Register</i> August 3, 1989) (T. 16 S., R. 07 W., NMPM).	Standard lease terms and conditions	No surface occupancy	Discretionary closure
Cultural Resources				
Lake Valley Historic Townsite (Map 3-10)	The townsite and schoolhouse are both listed on the State Register of Cultural Properties. The site is eligible to the National Register. Protection is through existing cultural resources regulations. The buildings are being stabilized and the site is open for public visitation. Approximately 140 acres (T. 18 S., R. 07 W., NMPM).	Standard lease terms and conditions	No surface occupancy	Discretionary closure

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Rattlesnake Hill Archaeological District (Map 3-10)	Existing management imposes controlled surface use. Vehicular use is limited to existing roads and trails in order to prevent damage to cultural resources (RMP Decision OGG-5). Existing management imposes no surface occupancy on Section 21, T. 22 S., R. 8 E., NMPM in order to protect sites listed on the State Register of Historic Places and sites proposed for nomination to the National Register of Historic Places (RMP Decision OGG-6). Closed to ORV activity on approximately 889 acres to protect cultural resources (RMP Decision C-2, <i>Federal Register</i> August 3, 1989).	No surface occupancy - Section 21, T. 22S., R.8E., NMPM; approximately 640 acres.	Discretionary closure - on approximately 889 acres and no surface occupancy on remainder of area approximately 2,726 acres.	Discretionary closure - Area equivalent to OGG-5, OGG-6, C-2, approximately 3,614 acres.
Lone Butte (Map 3-10)	Limited ORV use on approximately 352 acres to protect cultural resources (RMP Decision C-4, <i>Federal Register</i> August 3, 1989) (Section 6, T. 19 S., R. 09 E., NMPM).	Standard lease terms and conditions	No surface occupancy	No surface occupancy
Jarilla Mountains (Map 3-10)	Closed to ORV use on approximately 803 acres to protect cultural resources (RMP Decision C-5, <i>Federal Register</i> August 3, 1989) (T. 20 S., R. 08 E., NMPM).	Standard lease terms and conditions	Controlled surface use	Discretionary closure

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Mormon Battalion Trail (Maps 3-9 and 3-10)	Protection is through existing cultural resources regulations (Ts. 18, 19 S., Rs. 05-07 W., NMPM).	Standard lease terms and conditions	Controlled surface use - No surface-disturbing activities within 0.25 mile (400 meters) from each side of the trail; approximately 17,724 acres. Existing disturbance points could be used to cross the trail.	No surface occupancy within 0.25 mile (400 meters) from each side of the entire trail; approximately 17,724 acres. Existing disturbance points could be used to cross the trail.
Other historic trails (Maps 3-9 and 3-10)	No surface-disturbing activities are allowed in the area 0.25 mile (400 meters) from each side of the well-preserved segments of the trail on public land to protect cultural resources. # Butterfield Trail (RMP Decision C-6), (Ts. 25, 26 S., Rs. 12-14 E., NMPM) # Jornada del Muerto Trail (RMP Decision C-7), (Ts. 13-20 S., Rs. 01, 02 W., NMPM)	Controlled surface use – No surface-disturbing activities within 0.25 mile (400 meters) from each side of the well-preserved segments of trail.	Controlled surface use - No surface-disturbing activities within 0.25 mile (400 meters) from each side of the entire trail. Existing disturbance points could be used to cross the trail.	No surface occupancy within 0.25 mile (400 meters) from each side of the entire trail. Existing disturbance points could be used to cross the trail.

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Recreation and Visual Resources				
Tularosa River (Map 3-10)	Existing management imposes no surface occupancy to protect recreational opportunities along the Tularosa River (RMP Decision OGG-8, 119 acres). BLM gained additional acreage along the creek through the Tularosa Land Exchange. The acquired acreage along the Tularosa (213 acres) is not open to leasing. (Sections 29, 31, 32, T.13S., R.11E., NMPM.)	No surface occupancy (on RMP Decision OGG-8 area)	No surface occupancy (on RMP Decision OGG-8)	Discretionary closure (on RMP Decision OGG-8 area.)
Red Sands ORV Area (Map 3-10)	Red Sands ORV Area is a trail network within a sand dune area between Alamogordo and Orogrande; approximately 33,600 acres. The trails have been surveyed for cultural resources, and a plan to mitigate impacts on cultural resources is being implemented. Subsequently, the trails will be signed to encourage use of established trails and discourage proliferation of new trails (Ts. 19-21 S., Rs. 08, 09 E., NMPM).	Standard lease terms and conditions	Timing limitation - No drilling or seismic operations on weekends and for one week a year when the annual race occurs.	Discretionary closure (and no geophysical exploration allowed).
VRM Class I (Map 3-9)	Natural and ecological changes and very limited management activity are allowed. Any contrast created within the characteristic landscape must not attract attention. This classification is applied to wilderness areas, wild and scenic rivers, and other similar situations. The only BLM Class I VRM areas are ACECs, which are already closed to leasing. Approximately 10,126 acres total.	Discretionary closure	Discretionary closure	Discretionary closure

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
VRM Class II (Map 3-9)	Changes in any of the basic elements caused by a management activity should not be evident in the characteristic landscape. Contrasts are seen, but must not attract attention. Approximately 175,737 acres total.	Standard lease terms and conditions	Controlled surface use	Discretionary closure
VRM Class III (Map 3-9)	Contrast to the basic elements, caused by a management activity is evident, but should remain subordinate to the existing landscape. Approximately 309,797 acres.	Standard lease terms and conditions	Standard lease terms and conditions	Controlled surface use
VRM Class IV (Map 3-9)	Any contrast attracts attention and is a dominant feature of the landscape in terms of scale, but it should repeat the form, line, color, and texture of the characteristic landscape. Approximately 1,522,972 acres.	Standard lease terms and conditions	Standard lease terms and conditions	Standard lease terms and conditions

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
VRM and ORV limited areas (Map 3-10)	<p>Limited ORV use for protection of visual resources.</p> <p># Brokeoff Mountains VRM and ORV limited area, approximately 11,647 acres (RMP Decision VR-2) (T. 24-26 S., R. 18, 19 E., NMPM)</p> <p># Cornudas Mountains VRM and ORV limited areas (protection of watershed values and visual resources), approximately 2,533 acres (RMP Decisions W-1 and VR-3). Note: within this area, the Cornudas, Alamo, and Wind Mountains have all been designated as ACECs, closed to leasing (Ts. 25, 26 S., Rs. 13-15 E., NMPM).</p> <p># Cuchillo Mountains VRM and ORV limited areas, approximately 5,947 acres (RMP Decision VR-4) (T. 12 S., R. 11 W., NMPM)</p>	Standard lease terms and conditions	Controlled surface use	Discretionary closure (and no geophysical exploration allowed).
Cuchillo Mountains Piñon Nut Collection Area (Map 3-10)	The stands of piñon pine trees in the Cuchillo Mountains are maintained as a nut collection area, approximately 14,863 acres (RMP Decision R-2) (Ts. 10-12 S., R. 07, 08 W., NMPM).	Standard lease terms and conditions	Controlled surface use	Discretionary closure

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Lake Valley Back-country Byway (Map 3-10)	State Highway 152 from junction of Interstate 25, 18 miles south of Truth or Consequences, then west on Highway 152 to the historic town of Hillsboro. The Byway route then turns south onto Highway 27 towards Lake Valley and Nutt. The highway offers scenic views of the Black Range, Caballo, and Las Uvas Mountains and Cooke's Peak. Also, the route has high historic values founded on the basis of ranching and mining (Ts. 15-19 S., Rs. 05-07 W., NMPM).	Standard lease terms and conditions	Controlled surface use 0.25 mile (400 meters) to each side of the Byway, approximately 15,039 acres; short-term impacts allowed as long as the longer-term impacts (more than one year) are consistent with the VRM objectives for the Byway.	Discretionary closure within the foreground (0.25 mile [400 meters]), approximately 15,039 acres; no surface occupancy within the middle-ground (0.25 to 0.5 mile [400 to 800 meters]), approximately 15,214 acres; short-term impacts allowed in the distance-ground (0.5 to 1 mile [800 meters]), approximately 30,554 acres, as long as the long-term impacts (more than one year) are consistent with the VRM objectives for the Byway.

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Special Management Areas, Areas of Multi-Resource Management Concerns				
McGregor Range (not in BLM's Decision Area) (Map 3-10)	The McGregor Range management decisions (McGregor Range RMP Amendment, September 1990) are being carried forward unchanged. The withdrawal expires in 2001; however, it already has been extended to 2026. Approximately 606,198 acres.	The McGregor Range management decisions are being carried forward unchanged.	The McGregor Range management decisions are being carried forward unchanged.	The McGregor Range management decisions are being carried forward unchanged.

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Wilderness Study Areas (WSA) (Map 3-10)	<p>At present, WSAs are closed to leasing by statute and will continue to be managed in compliance with the Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM 1979, 1983) until they are reviewed and acted upon by Congress (RMP Decision OGG-2). If the WSA were designated as Wilderness, the area would remain closed to leasing and managed in compliance with the Wilderness Management Policy (BLM 1981).</p> <p># Jornada del Muerto WSA, approximately 4,320 acres (T. 10 S., Rs. 01, 02 E., NMPM) is recommended as suitable, based on the area's high quality wilderness values, special geologic features, wildlife and scientific values, lack of other resource users, and ease of manageability. If the WSA were not designated as Wilderness, its visual class would revert to Class III.</p> <p># Brokeoff Mountains WSA, approximately 30,838 acres (Ts. 22-26 S., Rs. 17-19 E., NMPM). If the area were not a WSA or wilderness, the area would still be VRM Class II.</p>	<p>Nondiscretionary closure. However, if the WSA is not designated as Wilderness, the area would be subject to standard lease terms and conditions.</p>	<p>Nondiscretionary closure. However, if the WSA is not designated as Wilderness, the area would be managed with controlled surface use to protect its resource values. Short-term impacts would be allowed as long as the longer-term impacts (more than one year) are consistent with the VRM objectives.</p>	<p>Nondiscretionary closure. However, if the WSA is not designated as Wilderness, the area would be discretionarily closed to leasing and geophysical explorations would not be allowed to protect its resource values.</p>

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Areas of Critical Environmental Concern (ACEC) (Map 3-10)	<p>The 1997 Otero County ACEC RMPA decisions are being carried forward unchanged, including the decision to close these areas to leasing and geophysical exploration.</p> <ul style="list-style-type: none"> # Three Rivers ACEC, approximately 1,130 acres (T. 11 S., R. 9½ E., NMPM) # Sacramento Escarpment ACEC, approximately 5,365 acres (Ts. 17-19 S., R. 10 E., NMPM) # Cornudas Mountain ACEC, approximately 861 acres (T. 25 S., R. 14 E., NMPM) # Alamo Mountain ACEC, approximately 2,525 acres (T. 26 S., R. 13 E., NMPM) # Wind Mountain ACEC, approximately 2,472 acres (T. 26 S., R. 14 E., NMPM) # Alkali Lakes ACEC, approximately 6,903 acres (T. 26 S., Rs. 18, 19 E., NMPM) 	Discretionary closure	Discretionary closure	Discretionary closure

**TABLE A-8
PLAN ALTERNATIVES CONSIDERED**

Resource Concern	Description and Existing Management Guidance	Range of Alternatives to Modify the Existing Management Situation		
		No Action (Existing Management)	A	B
Nominated ACECs (Map 3-8)	<p>Nominated as ACECs to protect resources as described below. BLM policy (Manual 1613.21E) is to manage nominated ACECs to maintain the conditions or resources of concern “until the area is fully evaluated through the resource management planning process.”</p> <ul style="list-style-type: none"> # Brokeoff Mountains nominated ACEC, approximately 3,834 acres, (T. 25 S., R. 19 E., NMPM) # Caballo Mountains nominated ACEC, approximately 2,213 acres (T. 16 S., Rs. 03, 04 W., NMPM) # Jarilla Mountains nominated ACEC, approximately 7,032 acres (Ts. 21, 22, S., R. 08 E., NMPM), # Mud Mountain nominated ACEC, approximately 2,580 acres (T. 13 S., Rs. 04, 05 W., NMPM) # Percha Creek nominated ACEC, approximately 940 acres (T. 16 S., R. 07 W., NMPM) (Includes 276-acre Percha Creek Riparian Habitat Area.) # Sacramento Mountains nominated ACEC, approximately 2,381 acres (Ts. 13, 14 S., R. 11 E., NMPM) # Six Shooter Canyon nominated ACEC, approximately 1,060 acres (T. 25 S., Rs. 21, 22 E., NMPM) # Pup Canyon nominated ACEC, approximately 3,677 acres (T. 22 S., R. 18 E., NMPM) 	Standard lease terms and conditions	Controlled surface use	Discretionary closure

APPENDIX A-VI STIPULATION FORMS

This appendix provides a list (Table A-9) of the resource concerns within BLM's Decision Area by the type of leasing restriction under BLM's preferred alternative (Alternative A). Leasing stipulation forms. Each form includes the stipulation; location(s); and waivers, exceptions, and modifications as appropriate, follow Table A-9 in the same order.

**TABLE A-9
RESOURCE CONCERNS BY TYPE OF RESTRICTION**

<p>Closed to Leasing - Nondiscretionary Closure</p> <ul style="list-style-type: none"># Old Air Force bombing and gunnery range# Public water reserves# Air navigation site# Wilderness Study Areas (WSA) (2) <p>Closed to Leasing - Discretionary Closures</p> <ul style="list-style-type: none"># Rattlesnake Hill Archaeological District# Visual Resource Management (VRM) Class I areas# Areas of Critical Environmental Concern (ACECs) (6) <p>Open to Leasing - No Surface Occupancy</p> <ul style="list-style-type: none"># Recreation and Public Purpose patents and leases# Community Pit 7 (Escondido)# Riparian/Other Wetlands/Playas# Ecological study plots (6)# Desert grassland habitat (Nutt and Otero Mesa)# Percha Creek Riparian Habitat Area# Lake Valley Historic Townsite# Lone Butte# Tularosa River <p>Open to Leasing - Controlled Surface Use and Timing Limitation</p> <ul style="list-style-type: none"># Bighorn sheep habitat

TABLE A-9
RESOURCE CONCERNS BY TYPE OF RESTRICTION

Open to Leasing - Controlled Surface Use

- # Berrendo Administrative Camp Site
- # Highly erosive or fragile soils
- # Watershed areas (5)
- # Big Game Habitat Areas
- # Special status species habitats
- # Jarilla Mountains
- # Designated historic trails (Mormon Battalion, Butterfield, and Jornada del Muerto)
- # VRM Class II areas
- # VRM and ORV limited areas (Brokeoff, Cornudas, and Cuchillo Mountains)
- # Cuchillo Mountains Piñon Nut Collection Area
- # Lake Valley Back-country Byway
- # Nominated ACECs (8)

Open to Leasing - Timing Limitation

- # White Sands Missile Range Safety Evacuation Zone
- # Red Sands ORV Area

CLOSED TO LEASING - NONDISCRETIONARY CLOSURES

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Nondiscretionary Closure**

RESOURCE CONCERN: Old Air Force Bombing and Gunnery Range

Location: Ts. 23, 24 S., Rs. 16, 17, 18 E., NMPM (approximately 8,264 acres)

Stipulation: Nondiscretionary closure; subsurface closed until such time as the restriction is removed

Objective: To ensure public safety of the former impact areas for the bombing and gunnery range

Previous Management: Public Land Order (PLO) 2569, RMP Decision L-2

Waiver: None

Exception: None

Modification: May occur when action is taken to remove the restriction prohibiting subsurface use of areas not open by PLO 2569. The stipulation cannot be modified at the local level; authority to modify is at the secretarial level.

Justification: Leasing is precluded in this area to ensure protection from previous military activities. Under standard lease terms and conditions, the requirements imposed for this area would remain the same.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Nondiscretionary Closure**

RESOURCE CONCERN: Public Water Reserves

Location: Various (must confer with BLM) (approximately 693 acres total)

Stipulation: Nondiscretionary closure

Objective: To ensure that the water resources within designated areas remain reserved for public use

Previous Management: PWR 107, 1926

Waiver: None

Exception: None

Modification: None

Justification: Public water reserves are closed to leasing by Executive Order (Order of Withdrawal, April 17, 1926). Under standard lease terms and conditions, the reserves also would be closed.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Nondiscretionary Closure**

RESOURCE CONCERN: Air Navigation Site

Location: Sections 17 and 18, T. 13 S., R. 01 W., NMPM (approximately 117 acres)

Stipulation: Nondiscretionary closure

Objective: To provide public land for use as an air navigation facility

Previous Management: Secretarial Order, Air Navigation Site Withdrawal No. 125

Waiver: None

Exception: None

Modification: None

Justification: Leasing is precluded in this area by Secretarial Order to protect the air navigation facility.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Nondiscretionary Closure**

RESOURCE CONCERN: Wilderness Study Areas (WSA)

Jornada del Muerto WSA

Location: T. 10 S., Rs. 01, 02 E., NMPM (approximately 4,320 acres)

Brokeoff Mountains WSA

Location: Ts. 22-26 S., Rs. 17-19 E., NMPM (approximately 30,838 acres)

Stipulation: Nondiscretionary closure

Objective: To protect the high-quality wilderness values of this area

Previous Management: 1986 RMP Decision OGG-2, Interim Policy and Guidelines for Lands Under Wilderness Review

Waiver: None

Exception: If not designated as wilderness, the area would be managed with controlled surface use to protect resource values. Short-term impacts would be allowed as long as the long-term impacts (one year) are consistent with the visual resource management (VRM) objectives. Reclamation must occur as soon as possible. Conditions of approval would be imposed such as paint color, judicious siting, use of closed pits, and reducing allowable pad size to less than 2 acres on wells subsequent to a "discovery well." Directional drilling may be required to allow multiple wells to be drilled from one pad.

Modification: None

Justification: That designated wilderness study areas (WSAs) should be closed to leasing is carried forward from the Wilderness Management Policy (BLM 1981). The controlled surface use stipulation for undesignated WSAs is deemed necessary to minimize surface-disturbing activities that would adversely impact resource values in the area. The no lease option and no surface occupancy stipulation are deemed overly restrictive since the BLM allows other surface disturbing resource activities within these areas.

CLOSED TO LEASING - DISCRETIONARY CLOSURES

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Discretionary Closure and No Surface Occupancy**

RESOURCE CONCERN: Rattlesnake Hill Archaeological District

Location: Section 21, T. 22 S., R. 8 E., NMPM (approximately 3,614 acres)

Stipulation: Discretionary closure and no surface occupancy

- # Closed to leasing on 889 acres
- # No surface occupancy on the remainder of the area (2,725 acres)

Objective: To protect cultural resources

Previous Management: 1986 RMP Decisions OGG-5, OGG-6, and C-2

Waiver: None

Exception: If an on-site investigation and surface use plan of operations demonstrates that surface occupancy can be confined to previously disturbed areas and can be accessed via existing roads.

Modification: None

Justification: The area that is closed to leasing coincides with the area in which off-road vehicle use is prohibited in order to protect cultural resource. Stipulating no surface occupancy is deemed necessary on the remainder of the site, since it is subject to existing cultural resource regulations due to its listing on the State Register of Cultural Properties and eligibility to the National Register. Closing this remaining portion of the area to leasing is not considered appropriate since impacts from operations can be mitigated by requiring no surface occupancy.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Discretionary Closure**

RESOURCE CONCERN: Visual Resources Management (VRM) Class I Areas

Location: Various (must confer with BLM) (approximately 10,126 acres total)

Stipulation: Discretionary closure

Objective: To protect visual resources

Previous Management: Closed to leasing by the Otero County Areas of Critical Environmental Concern (ACEC) Resource Management Plan Amendment (RMPA) (BLM 1997)

Waiver: None

Exception: None

Modification: None

Justification: The only Class I areas in the Planning Area are ACECs, which are already closed to leasing per the Otero County ACEC RMPA.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Discretionary Closure**

RESOURCE CONCERN: Areas of Critical Environmental Concern (ACEC)

- # **Three Rivers ACEC**
Location: T. 11 S., R. 9 ½ E., NMPM (approximately 1,130 acres)

- # **Sacramento Escarpment ACEC**
Location: Ts. 17-19 S., R. 10 E., NMPM (approximately 5,365 acres)

- # **Cornudas Mountas ACEC**
Location: T. 25 S., R. 14 E., NMPM (approximately 861 acres)

- # **Alamo Mountain ACEC**
Location: T. 26 S., R. 13 E., NMPM (approximately 2,525 acres)

- # **Wind Mountain ACEC**
Location: T. 26 S., R. 14 E., NMPM (approximately 2,472 acres)

- # **Alkali Lakes ACEC**
Location: T. 26 S., R. 18, 19 E., NMPM (approximately 6,904 acres)

Stipulation: Discretionary closure

Objective: To protect the high-quality resource values that have been identified in this area

Previous Management: Otero County ACEC RMPA (BLM 1997)

Waiver: None

Exception: None

Modification: None

Justification: The decision to close this area to leasing was made in the Otero County ACEC RMPA (BLM 1997), and these decisions will be carried forward unchanged.

OPEN TO LEASING - NO SURFACE OCCUPANCY

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Recreation and Public Purpose (R&PP) Patents or Leases

Location: Various (must confer with BLM) (approximately 1,799 acres total)

Stipulation: No surface occupancy

Objective: To ensure compatibility with the existing land uses in R&PP lease or patent areas

Previous Management: 1986 RMP Decision OGG-10

Waiver: May be granted if fluid mineral development is considered compatible with the land use in a specific R&PP area

Exception: Same

Modification: Leasing may be prohibited if it is not beneficial to the R&PP. The R&PP use cannot be subservient to another use.

Justification: The more restrictive stipulation of no surface occupancy was determined to be appropriate in order to address the possibility for land use conflicts (i.e., R&PP). The ability to grant waivers provides flexibility for less significant land use conflicts. Under standard lease terms and conditions, the stipulation for these areas would be the same.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Community Pit 7 (Escondido)

Location: Section 9, T. 20 S., R. 09 E., NMPM (approximately 30 acres)

Stipulation: No surface occupancy

Objective: To permit the continued use of this area by the public for mineral material extraction

Previous Management: 1986 RMP Decision LM-1. All activities are prohibited on weekends and for one week in mid-February, due to use of the nearby Red Sands off-road vehicle (ORV) area and an annual motorcycle race.

Waiver: None

Exception: May be granted if BLM determines that surface lease operations would not cause unnecessary effects on the area of use of the area

Modification: None

Justification: Stipulating no surface occupancy is needed to protect the mineral materials that are extracted by the public, and regulate the area in order to minimize unnecessary degradation. Under standard lease terms and conditions, the requirements described above would be similar; however, the no surface occupancy stipulation informs the lessee of the resource concern at the time the lease is acquired.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Riparian/Wetlands/Playas

Location: Various (must confer with BLM)

Stipulation: No surface occupancy within 0.25 mile (400 meters)

Objective: To minimize impacts on wetlands in compliance with Section 404 of the Clean Water Act and on riparian habitats in accordance with BLM guidelines

Previous Management: Section 404 of the Clean Water Act, general management guidance

Waiver: None

Exception: None

Modification: May be granted to allow some activities within 0.25 mile (400 meters) if it is determined from BLM analysis that there would be no adverse effect and that the area may be reclaimed effectively.

Justification: Stipulating controlled surface use is deemed necessary for areas that would not be avoided or protected under standard lease terms and conditions in compliance with the Clean Water Act. Closing such areas to leasing or stipulating no surface occupancy is deemed overly restrictive since controlling surface use could be effective in ensuring these areas are avoided.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Ecological Study Plots

Engle Ecological Study Plot

Location: Section 35, T. 13 S., R. 02 W., NMPM (approximately 40 acres)

Cuchillo Ecological Study Plot

Location: Sections 10, 11, 14, T. 12 S., R. 05 W., NMPM (approximately 1,471 acres)

Nordstrom Ecological Study Plot

Location: Sections 27, 28, 33, 34, T. 16 S., R. 05 W., NMPM (approximately 1,391 acres)

Trujillo Ecological Study Plot

Location: Section 3, T. 12 S., R. 06 W., NMPM (approximately 39 acres)

Danley Ecological Study Plot

Location: Section 18, T. 13 S., R. 09 E., NMPM (approximately 179 acres)

Lee Ecological Study Plot

Location: Section 21, T. 23 S., R. 13 E., NMPM (approximately 40 acres)

Stipulation: No surface occupancy

Objective: To protect the existing ecological resources in this area for research and scientific purposes

Previous Management: 1986 RMP Decision OGG-4, Public Land Order 4038

Waiver: None

Exception: None

Modification: None

Justification: Stipulating no surface occupancy is deemed necessary to protect the existing ecological resources. Under standard terms and conditions, the requirements for protecting these areas would be the same.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program – Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Desert Grassland Habitat

Location:

Otero Mesa Desert Grassland Area – Ts. 21 S. – 26 S., Rs 10 E. – 16 E., NMPM (coincident with Otero Mesa Habitat Area, refer to BLM mapping, approximately 116,206 acres)

Nutt Desert Grassland Area – Ts. 18 and 19 S., Rs. 5 – 7 W., NMPM (coincident with Nutt Antelope Area, refer to BLM mapping, approximately 16,265 acres)

Stipulation: No surface occupancy

No surface occupancy within core habitat area and adjacent buffer zones. In general, surface occupancy is allowed within 492 feet (150 meters) of existing roads as identified by BLM.

Objective: To protect portions of the remaining desert grassland community by minimizing habitat fragmentation.

Previous Management: General management guidance

Waiver: None

Exception: None

Modification: None

Justification: The core areas of desert grassland habitat identified contain large blocks of grassland habitats important in the maintenance of desert grasslands and species that inhabit them. A stipulation of no surface occupancy is necessary to ensure that the remaining blocks of grasslands are not fragmented further. The areas in particular are two relatively large blocks of desert grassland habitat remaining in the region and particularly on public land.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program – Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Percha Creek Riparian Habitat Area

Location: T. 22 S., R. 18 E., NMPM (approximately 276 acres)

Stipulation: No surface occupancy

Objective: To improve and protect this riparian area for wildlife habitat, watershed values, recreation, and visual quality

Previous Management: Case-by-case environmental analysis

Waiver: None

Exception: None

Modification: None

Justification: Stipulating no surface occupancy is deemed necessary to protect this area from surface-disturbing activities. Closing the area to leasing is not considered necessary since impacts can be mitigated by requiring no surface occupancy.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Lake Valley Historic Townsite

Location: T. 18 S., R. 07 W., NMPM (approximately 140 acres)

Stipulation: No surface occupancy

Objective: To preclude surface occupancy and new surface-disturbing activities within this recreational and cultural site

Previous Management: Existing cultural resources regulations

Waiver: None

Exception: None

Modification: None

Justification: Stipulating no surface occupancy is deemed necessary to protect the townsite and schoolhouse, which are subject to existing cultural resource regulations since both are listed on the State Register of Cultural Properties (as Site LA 50088) and are eligible for inclusion on the National Register of Historic Places. Closing the Lake Valley Historic Townsite to leasing is not considered necessary since impacts from operations can be mitigated by requiring no surface occupancy.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Lone Butte

Location: Section 6, T. 19 S., R. 09 E., NMPM (approximately 352 acres)

Stipulation: No surface occupancy

Objective: To protect cultural resources within the 352-acre area

Previous Management: 1986 RMP Decision C-4

Waiver: None

Exception: If an on-site investigation and surface use plan of operation demonstrates that surface occupancy can be confined to previously disturbed areas and can be accessed via existing roads.

Modification: None

Justification: Stipulating no surface occupancy is deemed necessary to protect cultural resources in accordance with existing BLM management. Off-road vehicle use also is limited to existing roads and trails on the approximately 300 acres in this area. Closing the area to leasing is not considered necessary since impacts from operations can be mitigated by requiring no surface occupancy.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
No Surface Occupancy**

RESOURCE CONCERN: Tularosa River

Location: Sections 29, 31, 32, T. 13 S., R 11 E., NMPM (approximately 119 acres)

Stipulation: No surface occupancy (213 acres of acquired land not open to leasing)

Objective: To protect recreational opportunities along the Tularosa River

Previous Management: 1986 RMP Decision OGG-8, Tularosa Land Exchange

Waiver: None

Exception: None

Modification: None

Justification: Stipulating no surface occupancy is deemed necessary to protect recreational opportunities along the river. Under standard lease terms and conditions, the same requirements apply. Closing the area to leasing is deemed overly restrictive in addition to the resource stipulations that would apply to this area.

**OPEN TO LEASING - CONTROLLED SURFACE USE AND TIMING
LIMITATION**

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program – Stipulation Form
Controlled Surface Use and Timing Limitation**

RESOURCE CONCERN: Bighorn Sheep (New Mexico Endangered Species)

Location: Sites with suitable habitat for bighorn sheep are located in the Caballo, Sacramento, Guadalupe, Brokeoff, and Cornudas Mountains. The Caballo Mountains provide a potential movement corridor for bighorn sheep from Fra Cristobal Mountains. (Approximately 199,020 acres)

Stipulation: Controlled surface use and timing limitation

No exploration or construction in important occupied habitat during lambing seasons (January through June).

Objective: To manage using reasonable measures necessary to protect potential habitat from degradation and to minimize adverse impacts on occupied habitat of bighorn sheep during lambing seasons (January through June).

Previous Management: General management guidance (special status species)

Waiver: May be granted if new habitat studies in coordination with BLM and New Mexico Department of Game and Fish conclude that an area is not affected by a proposed operation or is not being used as a lambing area by bighorn sheep.

Exception: May be granted if seasonal conditions are such that the bighorn sheep have moved out of and are not using the general area during a particular year.

Modification: None

Justification: Stipulating controlled surface use and timing limitation is deemed necessary to protect potential habitat from degradation and minimize potential impacts on occupied habitat of bighorn sheep, a New Mexico endangered species, during lambing seasons. Also, by stipulating controlled surface use and timing limitation and attaching it to a lease, the lessee is made aware of the requirements at the time the lease is acquired. Closing these areas to leasing or stipulating no surface occupancy is deemed overly restrictive since BLM allows other surface-disturbing activities within these areas. Under standard lease terms and conditions, activities can be delayed for only up to 60 days to avoid disturbance during the lambing periods which may not be sufficient to protect lambs.

OPEN TO LEASING - CONTROLLED SURFACE USE

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Berrendo Administrative Camp Site

Location: Section 9, T. 23 S., R. 15 E., NMPM (approximately 40 acres)

Stipulation: Controlled Surface Use

Objective: To protect an administrative camp site; no fluid minerals activities will be allowed within fenced area and within 350 feet (106 meters) of center of the helipad.

Previous Management: Public Land Order (PLO 6060), September 2, 1992; expires September 21, 2012

Waiver: None

Exception: None

Modification: May be granted to allow some activities if it is determined that there would be no adverse effect on administrative site facilities.

Justification: Controlled surface use is deemed necessary to avoid and protect BLM administrative site facilities (structure and helipad).

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Highly Erosive or Fragile Soils

Location: Various must confirm with BLM) (approximately 310,367 acres total)

Stipulation: Controlled surface use

Occupancy or use on fragile or highly erosive soils will be considered on a case-by-case basis. On those soils that are greater than 5 percent, mitigation measures may be applied (e.g., waterbars, reseeding, pad design changes, etc.)

Objective: To manage soils to maintain productivity and minimize erosion

Previous Management: General guidelines to manage soils in areas of high erosion potential to minimize surface disturbance to the extent possible

Waiver: None

Exception: None

Modification: May be granted if an on-site inspection demonstrates that these soils are not present on the specific site, slopes are low, and reclamation will be effective in mitigating impacts

Justification: Surface disturbance in these areas would cause accelerated erosion or increased instability, necessitating the stipulation of controlled surface use. Closing such areas to leasing or stipulating no surface occupancy is deemed overly restrictive due to the ability to mitigate impacts.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Watershed Areas

Wind and Chess Draw Watershed Area

Location: Rs. 25, 26 S., Rs. 13-16 E., NMPM (approximately 34,499 acres)

Note: A designated Area of Critical Environmental Concern (ACEC) is located within this area. The ACEC, which is highly valued for the habitat and scenic and recreational opportunities it contains, is closed to leasing in accordance with the Otero County ACEC Resource Management Plan Amendment (RMPA) (BLM 1997).

Mocassin and Otto Draw Watershed

Location: Ts., 20, 21, S., Rs., 14, 15 E., NMPM (approximately 13,662 acres)

Watershed east of Tularosa and south of Tularosa River

Location: Ts, 14, 15 S., Rs., 09, 10 E., NMPM (approximately 17,046 acres)

Three Rivers Watershed (north of Tularosa)

Location: T. 11 S., Rs. 09, 9 ½ E., NMPM (approximately 12,741 acres)

Watershed east of Crow Flats

Location: Ts., 24-26 S., Rs. 18, 19 E., NMPM (approximately 14,890 acres)

Stipulation: Controlled surface use

Objective: To protect watershed values in accordance with 1986 RMP Decisions

Previous Management: 1986 RMP Decisions W-1 W-2, W-3, W-4, and VR-3.

Waiver: None

Exception: None

Modification: May be granted (except in ACEC) if an on-site inspection demonstrates that resource values will not be jeopardized and reclamation will be effective in mitigating impacts.

Justification: Stipulating controlled surface use in the area other than the ACEC is deemed necessary for the remainder of the area to protect watershed values and ensure minimal effect on the integrity and long-term appearance of the area, including the scenic quality and opportunities for recreation. Closing the area to

leasing or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface-disturbing resource activities within the area. Under standard lease terms and conditions and in accordance with RMP Decision W-1, ORV use would be limited to existing roads and trails.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program – Stipulation Form
Controlled Surface Use**

RESOURCE: Big Game Habitat Areas

Otero Mesa Habitat Area (pronghorn)

Location: Ts. 21-26 S., Rs. 10-16 E., NMPM (approximately 427,275 acres)

Nutt and White Sands Antelope Areas (Jornada Plain)

Location: Nutt Antelope Area is T. 19 S., Rs., 07, 08 W. NMPM (approximately 75,850 acres); White Sands Antelope Area is Ts., 10-17 S., Rs. 01-04 W. And 01, 02 E., NMPM (approximately 453,709 acres)

Caballo Mountains Deer Area

Location: Ts. 14-17 S., Rs. 03, 04 W., NMPM (approximately 93,179 acres)

Sacramento Mountain Deer Area

Location: Ts. 11-15, 17 S., Rs. 08-10 E., NMPM (approximately 170,275 acres) (The southern portion of this area coincides with the Sacramento Escarpment ACEC)

Stipulation: Controlled surface use

Operations will be designed to avoid known populations and habitat. Each exploration and development project will be scrutinized carefully for potential effects on species and habitat. New disturbance will be minimized to reduce loss, fragmentation of, and edge effect in the habitat (e.g., use of existing roads and utility corridors; minimization of cross-country placement of roads and utility corridors, pipelines, and other rights-of-way). High potential for timing limitations and other conditions of approval resulting from BLM analysis.

Objective: To protect adequate habitat for big game species.

Previous Management: 1986 RMP Decisions WL-4, WL-8, WL-5, and WL-6.

Waiver: May be granted if new habitat studies in coordination with the BLM and New Mexico Department of Game and Fish conclude that the habitat area would not be affected by a proposed operation or the area is no longer used as a habitat by big game.

Exception: May be granted if no new roads or utility corridors are required.

Modification: None

Justification: To ensure that adequate habitat for big game is maintained in this area, stipulating controlled surface use is deemed necessary to maximize use of existing roads and/or utility corridors in order to maintain integrity of the habitat area and minimize the potential for further fragmentation. Closing the area to leasing or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface-disturbing activities within the area. Under standard lease terms and conditions, the requirements described above would be the same; however, the stipulation for controlled surface use informs the lessee of the resource concern at the time the lease is acquired.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program – Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Special Status Species Habitat (Federally listed threatened and endangered species, species proposed for Federal listing, Federal candidates, BLM sensitive species, and State-listed species)

Location: Various (must confer with BLM and U.S. Fish and Wildlife Service)

Stipulation: Controlled surface use

All exploration and development activities will follow current requirements of Section 7 of the Endangered Species Act for Federally listed and proposed species, and current BLM policy for management of State-listed and BLM sensitive species. Operations will be designed to avoid known populations and potential habitat. Each exploration and development project will be scrutinized carefully for potential effects on species and potential habitat. High potential for timing limitations and other conditions of approval resulting from BLM analysis.

Objective: To avoid adverse impacts on individual species and associated habitats.

Previous Management: Endangered Species Act, New Mexico Plant Species Act (9-10-10 NMSZ) and attendant Regulation 19 NMAC 21.2, Wildlife Conservation Act (NMSA 17-2-37 through 17-2-46, general management guidance

Waiver: May be granted if new studies conclude that the areas are no longer used as habitat for those species.

Exception: None

Modification: None

Justification: Stipulating controlled surface use is deemed necessary to minimize adverse impacts on protected species and their habitats, as required under the Endangered Species Act, New Mexico Plant Species Act (9-10-10 NMSZ) and attendant Regulation 19 NMAC 21.2, Wildlife Conservation Act (NMSA 17-2-37 through 17-2-46, and BLM authority. Closing these areas to leasing or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface-disturbing activities within the area. Under standard lease terms and conditions, the requirements described above would be the same; however, the stipulation for controlled surface use informs the lessee of the resource concern at the time the lease is acquired.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Jarilla Mountains

Location: T. 20 S., R. 08 E., NMPM (approximately 803 acres)

Stipulation: Controlled surface use

New disturbance will be minimized as follows:

- # Travel will be restricted to existing roads and trails

High probability of cultural resources mitigation requirements (implemented through Notice(s) to Lessees)

Objective: To minimize the high probability of cultural resources mitigation requirements

Previous Management: 1986 RMP Decision C-5

Waiver: None

Exception: If an on-site investigation and surface use plan of operation demonstrates that surface occupancy can be confined to previously disturbed areas and can be accessed via existing roads.

Modification: A modification may be implemented if an on-site investigation concludes that cultural resources do not exist in the area proposed for operations; however, there is a high probability that mitigation of impacts on cultural resources would be required. In addition, additional modifications may be implemented if significant cultural sites are identified in the area.

Justification: Stipulating controlled surface use is deemed necessary to ensure that impacts on cultural resources will be minimal and mitigatable. Also, off-road vehicle use is prohibited on approximately 705 acres in this area. Closing the area to leasing or stipulating no surface occupancy is not considered necessary since impacts can be anticipated and mitigated by requiring controlled surface use.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Designated Historic Trails (Mormon Battalion, Butterfield, and Jornada del Muerto)

Locations: Mormon Battalion Trail - Ts. 18, 19 S., Rs. 05-07 W., NMPM (approximately 17,724 acres); Butterfield Trail - Ts. 25, 26 S., Rs. 12-14 E., NMPM (approximately 4,333 acres); Jornada del Muerto Trail - Ts. 13-20 S., Rs. 01, 02 W., NMPM (approximately 14,018 acres)

Stipulation: Controlled surface use

New disturbance will be minimized as follows:

- # No surface-disturbing activities within 0.25 mile (400 meters) from each side of the trails (entire length)
- # Existing disturbance points could be used to cross the trails

Objective: To provide protection for existing cultural and scenic values associated with these trails

Previous Management: Protection of Mormon Battalion Trail through existing cultural resources regulations. Butterfield Trail protected by RMP Decision C-6 and Jornada del Muerto Trail protected by 1986 RMP Decision C-7. These decisions stipulate no surface disturbance within 0.25 mile (400 meters) of well-preserved sections of trail.

Waiver: None

Exception: Granted if it is demonstrated in a surface use plan of operations that no surface-disturbing activities will be visible from the trails, and that existing disturbed points/areas would be used to cross the trail

Modification: None

Justification: Stipulating controlled surface use is deemed necessary to minimize impacts on cultural resources. Closing the trails to leasing or stipulating no surface occupancy is not considered necessary since impacts can be mitigated by requiring controlled surface use.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Visual Resource Management (VRM) Class II Areas

Location: Various (must confer with BLM)

Stipulation: Controlled surface use

New disturbance will be minimized as follows:

- # Short-term impacts allowed as long as the longer-term impacts (one year) are consistent with the VRM Class II objectives
- # Reclamation must occur as soon as possible
- # Conditions of approval will be imposed such as paint color, judicious siting, and maximize use of existing roads and utility corridors
- # Directional drilling may be required with multiple wells drilled from one pad

Objective: To minimize contrasts to the characteristic landscape of each area.

Previous Management: BLM VRM objectives

Waiver: None

Exception: None

Modification: None

Justification: Stipulating controlled surface use is deemed necessary based on the need to protect visual resources in these areas. Closing these areas to leasing or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface-disturbing activities within these areas.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: VRM and ORV Limited Areas

Cornudas Mountains VRM and ORV Limited Area

Location: Ts. 25, 26 S., Rs. 13-15 E., NMPM (approximately 2,533 acres)

Cuchillo Mountains VRM and ORV Limited Area

Location: T 12 S., R. 11 W., NMPM (approximately 5,947 acres)

Brokeoff Mountains VRM and ORV Limited Area

Location: Ts. 24-26 S., Rs. 18, 19 E., NMPM (approximately 11,647 acres)

Stipulation: Controlled surface use

New disturbance will be minimized as follows:

- #** Short-term impacts allowed as long as the longer-term impacts (one year) are consistent with the visual resource management (VRM) objectives
- #** Reclamation must occur as soon as possible
- #** Conditions of approval will be imposed such as paint color, judicious siting, and using existing roads and utility corridors

NOTE: Within this area, the Cornudas, Alamo, and Wind Mountains have been designated as ACECs and are closed to leasing.

Objective: To protect watershed values and visual resources

Previous Management: 1986 RMP Decisions W-1 and VR-3, VR-4, and VR-2

Waiver: None

Exception: None

Modification: None

Justification: Stipulating controlled surface use is deemed necessary for these areas to protect watershed values and ensure minimal effect on the integrity and long-term appearance of the area, including the scenic quality and opportunities for recreation. Closing these areas to leasing or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface disturbing resource activities within the area.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Cuchillo Mountains Piñon Nut Collection Area

Location: Ts. 10-12 S., Rs. 07, 08 W., NMPM (approximately 14,863 acres)

Stipulation: Controlled surface use
Avoid destruction of piñon pine trees within this area

Objective: To maintain the current use of the stands of piñon pine trees as a public and commercial nut collection area

Previous Management: 1986 RMP Decision R-2

Waiver: None

Exception: None

Modification: None

Justification: Stipulating controlled surface use is deemed necessary to ensure continued use of the nut collection area. Closing the area to leasing or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface-disturbing activities within these areas.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Lake Valley Back-country Byway

Location: Ts. 15-19 S., Rs. 05-07 W., NMPM (approximately 15,039 acres)

Stipulation: Controlled surface use

New disturbance will be minimized as follows:

- # Surface-disturbing activities will be minimized within 0.25 mile (400 meters) of each side of the Byway, and long-term impacts will be consistent with visual resource management (VRM) objectives for the Byway
- # Conditions of approval will be imposed such as paint color, judicious siting, etc.

Objective: To protect the scenic resources along the Byway

Previous Management: Case-by-case evaluation of proposed actions along the Byway corridor

Waiver: None

Exception: None

Modification: None

Justification: Stipulating controlled surface use is deemed necessary to protect visual resources along the Byway. Closing the area along the Byway to leasing is deemed overly restrictive since the BLM allows other surface-disturbing activities within these areas.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program – Stipulation Form
Controlled Surface Use**

RESOURCE CONCERN: Nominated Areas of Critical Environmental Concern (ACEC)

- # **Brokeoff Mountains Nominated ACEC**
Location: T. 25 S., R. 19 E., NMPM (approximately 3,834 acres)

- # **Caballo Mountains Nominated ACEC**
Location: T. 16 S., Rs. 03, 04 W., NMPM (approximately 2,213 acres)

- # **Jarilla Mountains Nominated ACEC**
Location: Ts. 21, 22 S., R. 08 E., NMPM (approximately 7,032 acres)
(Note: A portion of the area is closed to off-road vehicle use on approximately 705 acres to protect cultural resources, 1986 RMP Decision C-5)

- # **Mud Mountain Nominated ACEC**
Location: T. 13 S., Rs. 04, 05 W., NMPM (approximately 2,580 acres)

- # **Percha Creek Nominated ACEC**
Location: T. 16 S., R. 07 W., NMPM (approximately 940 acres)

- # **Sacramento Mountains Nominated ACEC**
Location: Ts. 13, 14 S., R. 11 E., NMPM (approximately 2,381 acres)

- # **Six Shooter Canyon Nominated ACEC**
Location: T. 25 S., Rs. 21, 22 E., NMPM (approximately 1,060 acres)

- # **Pup Canyon Nominated ACEC**
Location: T. 22 S., R. 18 E., NMPM (approximately 3,678 acres)

Stipulation: Controlled surface use

Operations will be designed to avoid known populations and for habitat. Each exploration and development project will be scrutinized carefully for potential effects on species and/or habitat. High potential for other conditions of approval resulting from BLM analysis.

Objective: To protect the known and/or potential biological communities at each.

Previous Management: Case-by-case environmental analysis

Waiver: None

Exception: None

Modification: None. Additional modifications and conditions of approval may be implemented if this area is designated as an ACEC.

Justification: Stipulating controlled surface use is deemed necessary based on the stipulations associated with the other resource concerns needed to protect the resource values in the area. Closing the area or stipulating no surface occupancy is deemed overly restrictive since the BLM allows other surface-disturbing activities within the area. Under standard lease terms and conditions, the requirements described above would be similar; however, the stipulation of controlled surface use informs the lessee of the resource concern at the time the lease is acquired.

OPEN TO LEASING - TIME LIMITATION

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Timing Limitation**

RESOURCE CONCERN: White Sands Missile Range Safety Evacuation Zone

Location: Ts. 10-17 S., Rs. 01, 02 E. and 01 W., NMPM (approximately 311,410 acres)

Stipulation: Timing limitation

Objective: To provide protection to the public on days when missiles will be fired

Previous Management: 1986 RMP Decision OGG-1

Waiver: None

Exception: None

Modification: None

Justification: To ensure that the area will be restricted during missile firings. Closing the area to leasing or stipulating no surface occupancy is deemed overly restrictive since the area is viable for fluid minerals development during other times. Prior to beginning exploration activities, the lessee must contact the Corps of Engineers in Albuquerque and the Master Planning Branch at White Sands Missile Range to be advised of the terms of the safety evacuation agreement and missile-firing schedules. Under standard lease terms and conditions, the requirements posed by this stipulation would remain the same.

**BUREAU OF LAND MANAGEMENT
LAS CRUCES FIELD OFFICE**

**Fluid Minerals Program - Stipulation Form
Timing Limitation**

RESOURCE CONCERN: Red Sands Off-road Vehicle (ORV) Area

Location: Ts. 19-21 S., Rs. 08, 09 E., NMPM (approximately 33,600 acres)

Stipulation: Timing limitation

New disturbance will be minimized as follows:

- # No seismic operations or drilling on weekends and for one week each year when the annual motorcycle race takes place

Objective: To protect the existing opportunities for recreational off-road vehicle (ORV) use and minimize the effects of fluid mineral development activities

Previous Management: Case-by-case evaluation of proposed actions within the ORV area. Also see Community Pit 7.

Waiver: None

Exception: None

Modification: None

Justification: Stipulating the timing limitation is deemed necessary to minimize impacts on recreational activities that occur in this area. Closing the area to leasing, or stipulating no surface occupancy or controlled surface use, is deemed overly restrictive because recreation in this area would not be impacted significantly by activities during weekdays.

APPENDIX B-I
STANDARD OPERATING PROCEDURES FOR EXPLORATION,
DEVELOPMENT, PRODUCTION, AND ABANDONMENT—
OIL AND GAS

Once an oil and gas lease has been issued, the lessee or operator is granted the right to conduct certain operations on the leased lands (unless otherwise limited by special stipulations in the lease). The purpose of this appendix is to provide the reader with a general description and understanding of typical activities and current standard operating procedures that can be anticipated to occur for oil and gas exploration, development, production, and abandonment. The general information presented in this appendix is an integral part of the assumptions made in the analyses for this Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS) (refer to Chapters 2 and 4 and Appendix A-III). It was assumed that the technology of oil and gas exploration and development will not change significantly during the life of this document; that is, to the extent that the RMPA/EIS decisions are affected.

Successful exploration and development generally progresses through five basic operational phases. These include (1) preliminary investigation (includes geophysical exploration), (2) exploratory drilling, (3) development, (4) production, and (5) abandonment. Several operational phases can occur in the same area at the same time. One company may drill an exploratory well on a lease while another company conducts preliminary investigations nearby. A lapse of several months or perhaps years may occur between the preliminary investigation and exploratory drilling phases. A lapse of several weeks, months, or years also may occur between the exploratory drilling and development phases. The development and production phases may occur simultaneously, especially if a large field has been discovered. On average, only a relatively small percent of the wildcat (exploratory) wells drilled in the United States are successful.

It may take several years to determine whether an exploratory well is a financial success. If it is a success, the operations progress through the three remaining phases over a time span that may range up to 50 years. The lapsed time between the production and abandonment phases of a field may be 15 to 20 or more years.

If geophysical exploration and/or exploratory drilling are unsuccessful in discovering a commercial deposit, operations are terminated and abandonment is initiated. The operation also may proceed directly from development to abandonment if one or more of the development wells is unsuccessful.

PRELIMINARY INVESTIGATIONS

A lease is not required to conduct preliminary investigations for Federal oil and gas; however, geophysical operations must be reviewed and a permit must be approved by the surface-management agency. Refer to Chapter 1 of the Surface Operating Standards for Oil and Gas Exploration and Development “Gold Book”¹ for a description of the permitting processes required by the Bureau of Land Management (BLM). BLM Manual H-3150-1 also describes surface-management requirements.

Indications of the presence of oil and gas can be obtained by various prospecting methods including geologic, geochemical, and remote investigations (e.g., examination of rock outcrops, seeps, and topography) and geophysical investigations (e.g., gravity, geomagnetic, and seismic reflection surveys). Prospecting via geophysical investigations means does not guarantee a successful find, but the combination of geophysical information and geological understanding reduces the chances of drilling a dry hole (unsuccessful test). These prospecting methods are described below.

Geologic and Remote Investigations

Geologic investigation begins with a review of geologic and technical data available for the area of interest. If this preliminary data indicate a potential for oil and gas, information for specific areas or trends are evaluated. If the area does not have a history of producing, no previous wells have been drilled, and the preliminary data suggest conditions are favorable for oil and gas, an extensive geophysical exploration program covering a large area may be undertaken to collect the subsurface data in order to evaluate the oil and gas producing potential.

Remote investigations may be conducted either from the air or on the ground. These are preliminary investigations that involve only casual use (i.e., minimal surface or subsurface disturbance) and no permits are required. However, the investigators must comply with the rules and regulations of the appropriate surface-management agency. A Federal oil and gas lease does not grant an exclusive right to conduct remote investigations and geophysical exploration. These activities may be conducted prior to or after leasing by either the lessee or someone other than the lessee. These investigations may result in an expression of interest to lease specific areas.

¹Third edition, prepared by the Bureau of Land Management and Forest Service Rocky Mountain Regional Coordinating Committee, January 1989.

Geological Surveys

Geological surveys normally are a casual use. Rock outcrops and topography are examined visually to determine the structural attitude and age of surface formation, and surface maps are prepared. In some areas, sufficient information may be obtained to enable the geologist to recommend a drilling location without conducting additional exploration work.

Geochemical and Soil-gas Surveys

Geochemical and soil-gas surveys involve casual use of the land. In geochemical surveys, the chemical contents of water, soil, or vegetative samples are analyzed for the minute presence of oil or gas.

Geophysical Prospecting

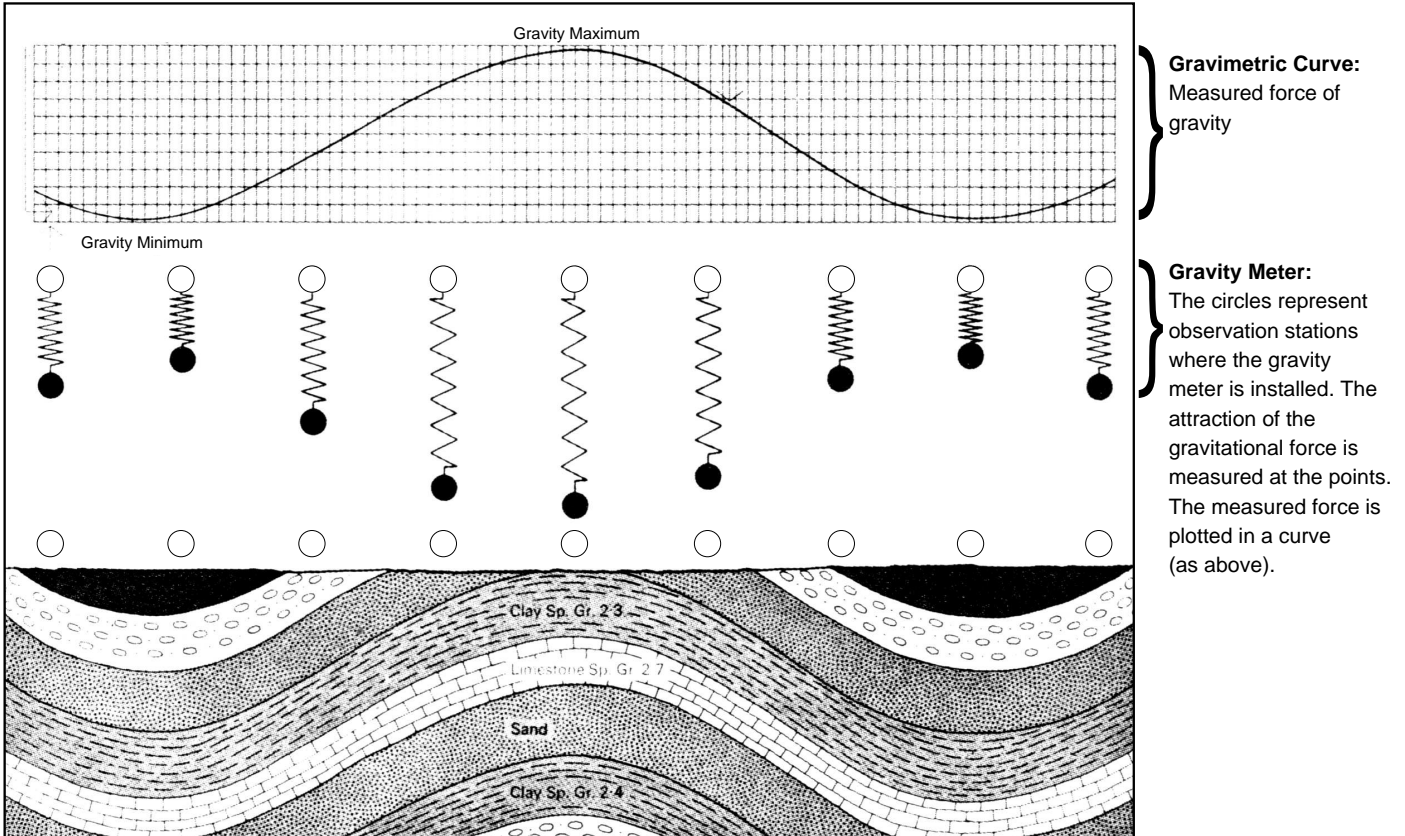
Geophysics deals with the composition and physical phenomena of the earth and its liquid and gaseous environments. The phenomena most commonly interpreted in oil and gas exploration are earth magnetism, gravity, and especially seismic vibrations. Sensitive instruments are used to measure variations in a physical quality that may be related to subsurface conditions. The interpretations of these conditions, in turn, indicate probable oil- or gas-bearing formations.

Gravity Surveys

Gravitational prospecting detects micro-variations in gravitational attraction caused by the differences in the density of various types of rock. Data derived from gravity surveys are used to generate anomaly maps from which faults and general structural trends can be interpreted (Figure B-1). Gravity surveys generally are not considered definitive due to the many data corrections required (e.g., terrain, elevation, latitude, etc.) and the poor resolution of complex subsurface structures. Therefore, gravity surveys may be used in conjunction with other methods.

The instrument used for gravity surveys is a small portable device called a gravimeter, which can be carried by an individual. Generally, measurements are taken at many points along a linear transect looped back to a reference point that is repeated by sample. The gravimeter is transported either by backpack, helicopter, or off-road vehicle (ORV).

There is little surface disturbance associated with gravity prospecting except that which may be caused by ORV use to transport equipment.



Gravity Meter Survey Principles

Figure B-1

Geomagnetic Surveys

Magnetic prospecting is used to a limited extent in oil and gas exploration. Magnetic surveyors use an instrument called a magnetometer to detect small magnetic anomalies in the earth's crust. Magnetic surveys can detect large trends or lineaments in basement rocks and the approximate depth to those basement rocks, but in general magnetic surveys provide little specific data to aid in petroleum exploration. Again, many data corrections are required to obtain reliable information and maps generated from magnetic data lack resolution and are considered preliminary. Magnetometers vary greatly in size and complexity and in general most magnetic surveys are conducted from the air by suspending a magnetometer under an airplane. Magnetic surveys conducted on the ground are nearly identical to gravity surveys and there is little or no surface disturbance.

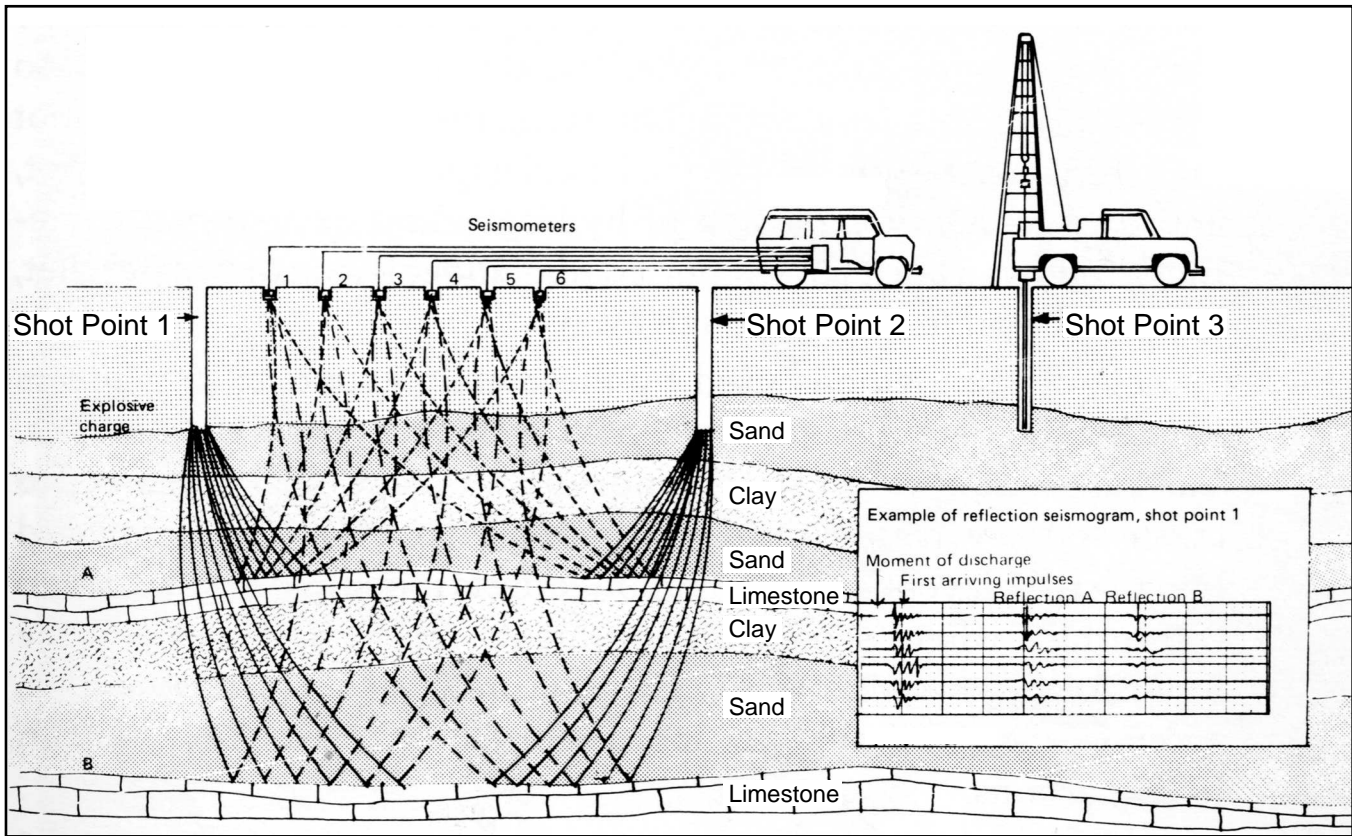
Seismic Reflection Surveys

Seismic prospecting is the most common indirect method used for locating subsurface structures that may contain oil and/or gases. Shock waves are induced into the earth using one of several methods. Vibroseis and drilling/explosives are the two most commonly used methods for producing the shock wave. These waves travel downward and outward encountering and reflecting off of various strata, each having a different seismic velocity. Sensing devices called geophones are placed on the surface to detect these reflections. The geophones are connected to a data recorder, which stores the data. The time required for the shock waves to travel from the seismic energy source down to a given reflector (a change in rock strata) and back to the geophone can be correlated to the depth of the reflector (Figure B-2). The data collected are then processed by computer to create a velocity/amplitude image of the subsurface geology in time.

Seismic surveys can be conducted two-dimensionally (2-D) (line with vertical depth) or three-dimensionally (3-D). The 2-D seismic programs are carried out with the shots (source of energy or vibration) and receivers (from sensing devices) on or offset slightly from the same line. In 3-D seismic programs, the shots and receivers are arranged in an areal pattern on the ground surface that may vary considerably in dimension. The advantages of 3-D surveys are the processing possibilities, reduction in the assumptions made during 2-D processing, and alignment and design of the survey to the prospect.

Vibroseis Surveys

The thumper and vibrator methods pound or vibrate the earth to create the shock wave. Usually three to five large trucks, each equipped with vibrator pads (about 4 feet [1.2 meters] square), are used. The pads vibrate the ground surface along a series of linear routes that are defined for each project's survey area. In 3-D surveys, long cables that contain sensors are placed perpendicular to the source lines in order to detect the reflected vibrations. The pads are lowered to the ground and vibrators



Explosive charge at shot point 1 creates shock waves that are reflected by subsurface formations to seismometers and are recorded by equipment in truck.

Principles of Seismic Reflection Survey

Figure B-2

on all trucks are turned on simultaneously. Information is recorded, the trucks are moved forward a short distance, and the process is repeated. Truck traffic is generated by the trucks along source lines, trucks needed to lay the sensor cables and receiver lines that report the detections to a central monitoring area, and by trucks needed to conduct repairs on receiver lines. Surface disturbance occurs along access routes if off-road travel is required, although little surface area is required to operate the equipment at each test site. All-terrain vehicles (ATVs) may be used in place of trucks to reduce impacts on test sites. The 3-D surveys often involve greater surface disturbance due to the grid layout that is used in place of the linear 2-D method.

Drilling/Explosives

The drilling method uses truck-mounted drills that drill small-diameter holes to depths of 30 to 200 feet (9 to 61 meters). Four to 12 holes are drilled per mile of line. Usually, a charge of explosives is placed in the hole, covered, and detonated. The amount of dynamite needed for a reflection shot varies from less than 1 pound to several hundred pounds, depending on the nature of the material in which the shot is fired. The explosion sends energy waves that are reflected back to the surface from subsurface rock layers. The holes are drilled along a line that can be miles in length. In rugged topography, inaccessible to wheeled vehicles, a portable drill may be transported by helicopter.

Under normal conditions, 3 to 5 miles of line can be surveyed each day using the explosive method. The vehicles used for a drilling program include several heavy truck-mounted drill rigs, water trucks, a computer recording truck, and several light pickups for the surveyors, shot-hole crew, geophone crew, permit person, and party chief. Public roads and existing private roads and trails are used to the extent possible. Off-road, cross-country travel also is necessary. Motor graders and/or dozers may be required to provide access to remote areas. Several trips a day are made along a seismograph line, which usually establishes a well-defined two-track trail. Drilling water, when needed, is usually obtained locally.

Primacord

Another seismic technique involves the use of explosive cord. The cord is buried in a 2.5-foot (0.75-meter)-deep furrow that is plowed by a specially designed mechanical plow mounted on a tractor. Multiple sets of cord, often in a pattern, are buried at the same time. This method offers efficiency advantages over the shot-hole seismic method in that it is faster, less costly, and the quality of the data is often improved. However, surface disturbance may be considerably greater than with the shot-hole seismic method.

Post-Lease Preliminary Investigations

If interpretation of preliminary investigations indicate that an oil or gas trap may exist in an area, the company may secure leases either directly through the Federal leasing system or from existing leaseholders through assignment (lease is purchased and ownership is assigned). Additional preliminary investigations may be carried out after a lease is acquired. Post-leasing investigations may include airborne and surface operations similar to those of the preleasing phase. The lessee may intensify the seismic studies by laying out a criss-cross pattern of lines tying to the previous seismic lines, or conduct 3-D seismic surveys. Other preliminary investigations also may be initiated prior to drilling.

EXPLORATORY DRILLING

Where preliminary interpretations are favorable and data warrant further exploration, exploratory drilling is conducted. More precise data on the geologic structure may be obtained by stratigraphic tests. The presence of suspected oil and gas deposits may be confirmed by exploratory (wildcat) drilling of deep holes.

Permitting Process

Exploratory drilling is authorized only by a Federal oil and gas lease, but cannot be conducted unless an Application for Permit to Drill (APD) is approved containing an adequate Surface Use Plan of Operations (SUPO) and drilling plans.

Proposed construction of the well location and access roads, and other facilities and operations that involve surface disturbance conducted under the terms of a lease must be approved by the appropriate surface-management agency before such activities are conducted. Regardless of which surface-management agency, the proposed development of a Federal lease (i.e., Federal minerals) must be approved by BLM. Operations must be approved and conducted in accordance with (1) lease terms; (2) 43 CFR 3160; (3) 36 CFR 228, Subpart E; (4) Onshore Oil and Gas Order No. 1, and other onshore oil and gas orders; (5) applicable Notices to Lessees (NTLs); (6) any conditions of approval; and (7) any subsequent orders of the authorized officers of the BLM.

No drilling operations or related surface disturbance can be conducted without an approved APD. There are two options available to the oil and gas operator when applying for approval of an APD. After the company makes the decision to drill a well, they submit a Notice of Staking (NOS) prior to submitting an APD, or it may submit only an APD.

Notice of Staking

The NOS consists of an outline of what the company intends to do including a location map and sketched site plan and lease description. The NOS document is reviewed by BLM to identify any conflicts with known resource values. Also, it is used during the on-site inspection and to provide the preliminary data to assess what items are needed to complete an acceptable surface use plan and drilling program.

Application for Permit to Drill

An operator or lessee must submit a completed APD to the BLM whether or not the NOS is used. An APD includes a drilling plan, which consists of a surface use program and a drilling program. The detailed information required to be submitted under each program is identified in Onshore Oil and Gas Order No. 1 and 36 CFR 228, Subpart E. An onsite inspection of the proposed well site, road location, and other areas of proposed surface use is conducted prior to approval. The inspection team may include, but not be limited to, BLM representatives, the lessee or operator, operator's principal drilling and construction contractors, and other relevant parties. The purpose of the on-site inspection is to identify issues and potential environmental impacts associated with the proposal and the methods for mitigating those impacts. These may include making adjustments to the proposed well site and road locations, identifying the construction methods to be employed, and identifying reclamation standards for the lands after drilling. Environmental documentation must be completed to satisfy the National Environmental Policy Act. The surface-management agency may choose to provide mitigation measures. The BLM is responsible for approval of the drilling program, protection of groundwater resources, and final approval of the APD.

When final approval is given by BLM and 30 days has transpired, the operator may commence construction and drilling operations. Approval of an APD is valid for one year. If construction does not begin within one year, the stipulations must be reviewed prior to providing an extension or approving another APD.

Other proposals to occupy the surface that involve surface disturbance, but are not associated with drilling a well, also must receive advance approval under the procedures described above.

Stratigraphic Tests

Stratigraphic test holes may be drilled 100 to 500 feet (30 to 152 meters) deep to locate geologic indicators as part of the lease venture. The holes are usually drilled with truck-mounted equipment and disturb a relatively small area. Casing is needed for stratigraphic holes in areas of shallow high-pressure zones. The roads and trails constructed for access to the test sites are temporary and involve minimal construction. Only one to three days are required to drill each hole. The drill site occupies an area

approximately 30 feet by 30 feet (9 meters by 9 meters) and is sometimes placed in the center of a new or existing trail.

Wildcat Wells

Wildcat wells are deeper tests, require larger drilling rigs with support facilities, and may disturb a larger surface area than stratigraphic tests. Construction of access roads, drill pads, reserve pits, and, in some cases, worker camps and helipads, are required to conduct exploratory drilling operations.

The well site is selected on the basis of prior surface investigations, seismic surveys, data from other wells that have been drilled in the area. Other considerations may include topography, accessibility, requirements of lease stipulations, and protection of surface resources.

Usually, attempts are made to locate wells sites on the most level location available that accommodates the intended use consistent with reaching the geologic target. The drill site layout also can be oriented to conform to or fit into the topographic conditions at the drill site. However, safety considerations in a hydrogen sulfide (H₂S) area may be an overruling factor when determining the topographic setting and providing adequate escape routes for the drill crew. In general, steeply sloping locations, which require deep, nearly vertical cuts and steep fill slopes, are avoided or appropriately mitigated. The well site also is reviewed to determine its effect in conjunction with the location of the access road.

Surface Requirements and Construction

Upon approval of the APD, construction may begin within the leasehold. If facilities (e.g., tank batteries, pipelines, truck depots, power lines, and access roads) that occupy Federal land outside the lease or unit boundary, a right-of-way also is required. The right-of-way is issued by the surface-management agency.

A general description of surface requirements and construction of roads and well sites follows.

Roads

Moving equipment to the construction site requires moving several semitruck loads (some overweight and over-width) over public and private roads. Generally, existing roads and trails are used to the extent practical and improved where needed to accommodate the construction traffic. This may include installation of culverts and cattle guards, if needed. The lengths of access roads vary. Generally, the shortest feasible route consistent with the topography is selected to reduce the haul distance and

construction costs. In some cases, potential environmental impacts or existing transportation plans dictate a longer route. On public land in New Mexico, roads are constructed in accordance with the policy of the New Mexico State Office of BLM.

Road width may vary depending on the use of the road; however, access roads to a well site are usually constructed to a 12- to 16-foot (3.6- to 4.8-meter)-wide travel surface (in relatively level terrain).

Road surfacing may be required because of adverse soil conditions, steepness of grade, and moisture conditions. The total acreage disturbed for each mile of access road construction varies significantly with steepness of slope. In rough terrain the type of construction is sidecasting, where the material taken from the cut portion of the road is used to construct the fill portion.

If a well is plugged, roads may require reclamation. If a well is productive, roads may have to be upgraded and maintained.

Well Sites

Well site selection and construction incorporates considerations of the amount of level surface required for safe assembly and operation of a drilling rig. The amount of level surface area safely assembling and operating a drill rig varies with the type of rig, but averages 400 feet by 400 feet (122 meters by 122 meters); however, not all of the drill site may be used. In some cases, a larger area may be required; for example, the drill sites in the Bennett Ranch Unit are 400 feet by 600 feet (122 meters by 183 meters) for safety reasons in this area.

Well sites located on flat terrain usually require little more than removing the topsoil (all soil material suitable for plant growth) and vegetation from the site and then a base (e.g., of caliche) is built for the stability of the drilling rig.

Well sites on ridge tops and hillsides are constructed by cutting and filling portions of the location to provide a level area (drill pad) to accommodate the drill rig, ancillary facilities, and drilling operations. Normally, at least 25 feet (7.6 meters) (between the drill point and outer edge of the drill pad) is required to be on an area of cut instead of fill. The substructure of the drilling derrick must be located on solid ground as settling of uncompacted fill material under the drill rig may cause the substructure and derrick to lean and even fall. The majority of excess cut material may need to be stockpiled in an area that will allow easy recovery for reclamation.

In addition to the drill pad, a reserve pit is constructed to accommodate spent drilling fluids and cuttings resulting from drilling, and to provide a large quantity of mud to control pressure variations during drilling. The pit is usually square or oblong, but may be constructed in another shape to accommodate topography. The reserve pit is a depth determined sufficient to accommodate the particular situation,

but normally is not deeper than 8 feet (2.4 meters). The pit must be deep enough to completely cover cuttings, dried drilling fluids, and produced fluids to a depth of 3 or more feet (0.92 or more meters). This decreases plant mortality and improves reclamation success.

Depending on the relation of the drill site to natural drainages, it may be necessary to construct waterbars or diversions. The size of the area disturbed for construction and the potential for successful revegetation often depends on the steepness of the slope.

The drilling rig and its attendant facilities such as pumps, mud tanks, generators, pipe racks, tool house, etc., are located on the drill pad. Other facilities such as storage tanks for water and fuel may be located on or near the drill pad. Depending on the remoteness of the location, house trailers also are provided to house workers during drilling operations.

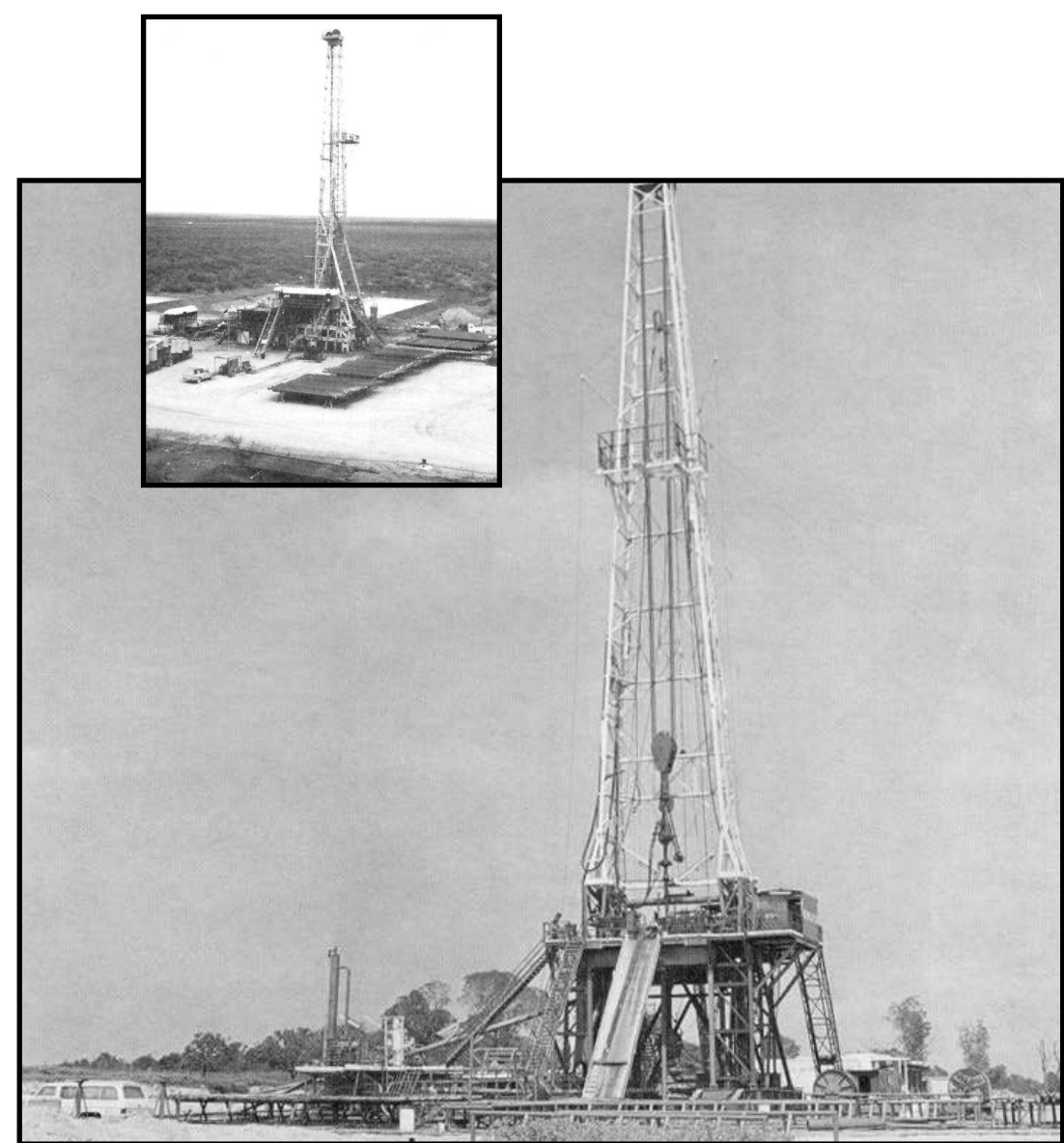
Drilling Operations

After well site and access road construction is completed, the drilling rig and associated equipment are moved to the site and erected. Moving a drilling rig requires 30 to 40 truckloads of equipment over public highways and private roads.

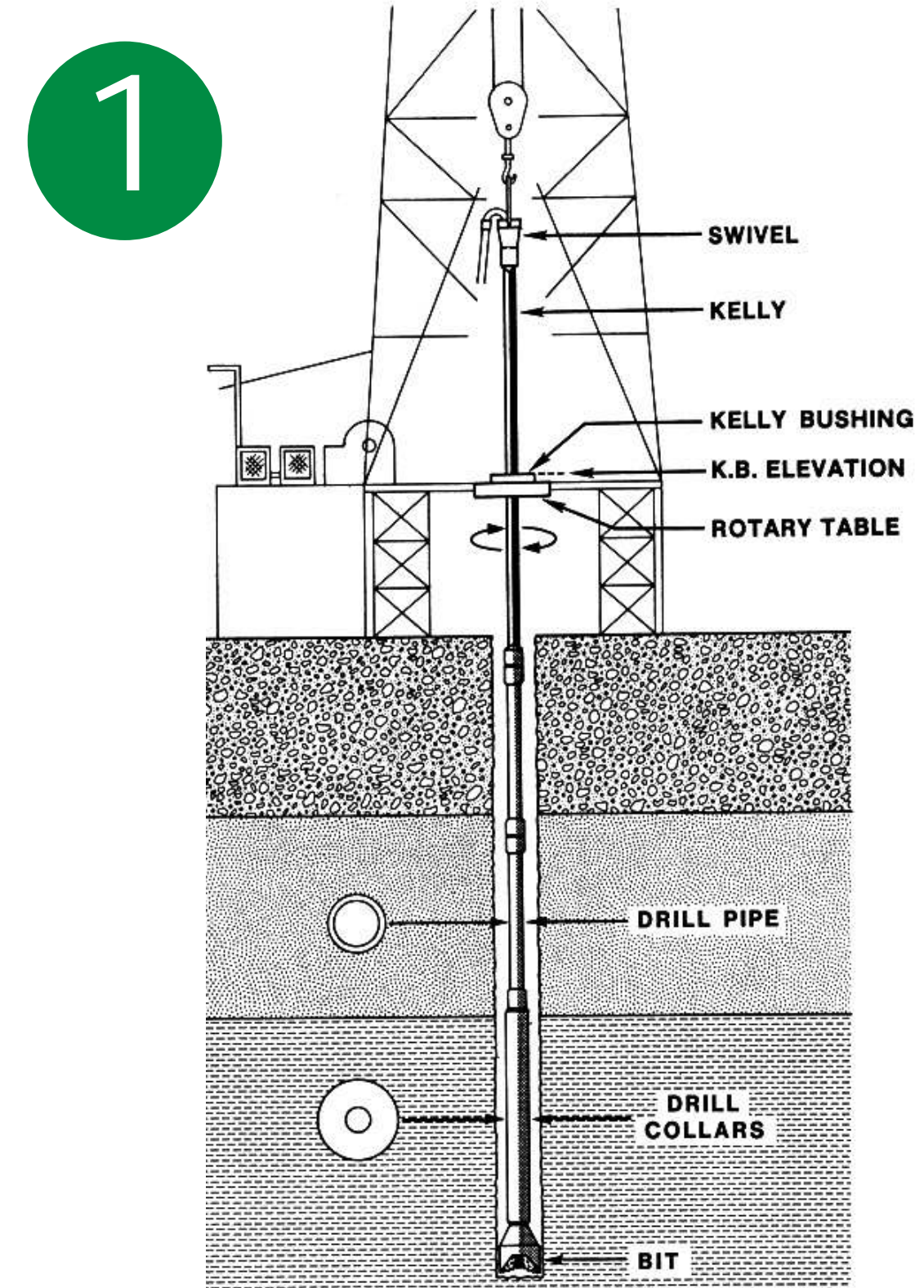
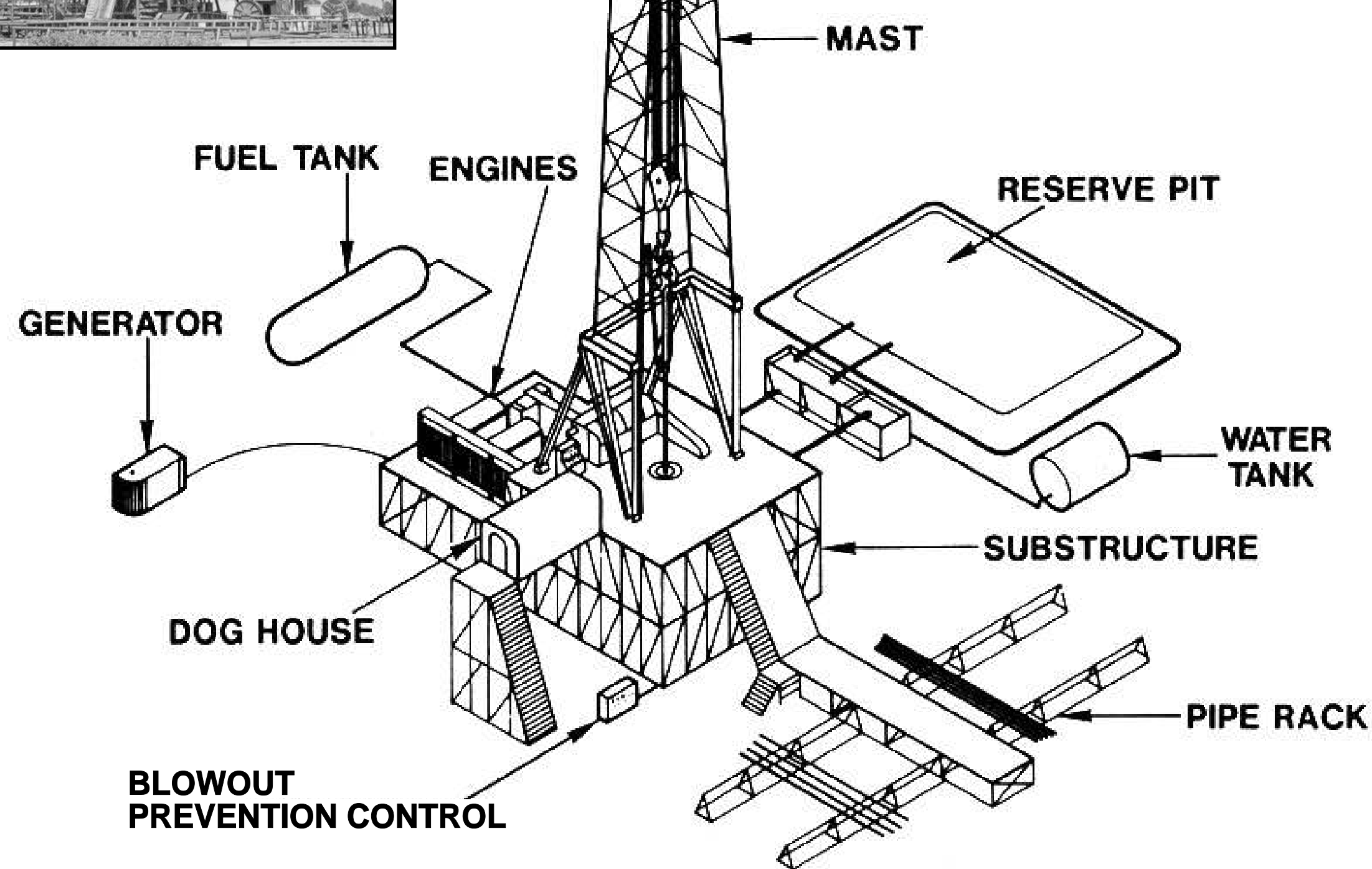
The most commonly used well drilling equipment is the rotary rig, which consists of (1) the rotary system, which consists of the drill bit attached to a length of tubular high tensile steel “drill-stem pipe” (collectively called the “drill string”) which is turned by a rotary table; (2) the mud-circulating system consisting of mud tanks, mud pumps, and reserve pit; (3) a hoisting system, which consists of a derrick (“mast”), crown block, and traveling block used to lift and lower the drill; (4) a power system, normally diesel-engine-powered electric generators; and (5) blowout prevention system that prevents high-pressure fluids in deep wells from escaping to the surface (Figure B-3). Other equipment includes tanks for drilling fluids and fuels.

Depending on the height of the substructures, the derrick may rise to more than 160 feet (48 meters) above the ground surface and is the most visible and noticeable feature of a drill rig. The commencement of drilling operations is commonly referred to as “spudding” the well. The actual drilling is accomplished by passing the drill string through the rotary table, which turns the drill string and bit, which in turn performs the actual drilling. The weight of the drill string provides downward pressure on the drill bit, which chips and pulverizes the rock as it rotates in the bottom of the hole. By continually adding more drill-stem pipe to the drill string, the hole is steadily deepened.

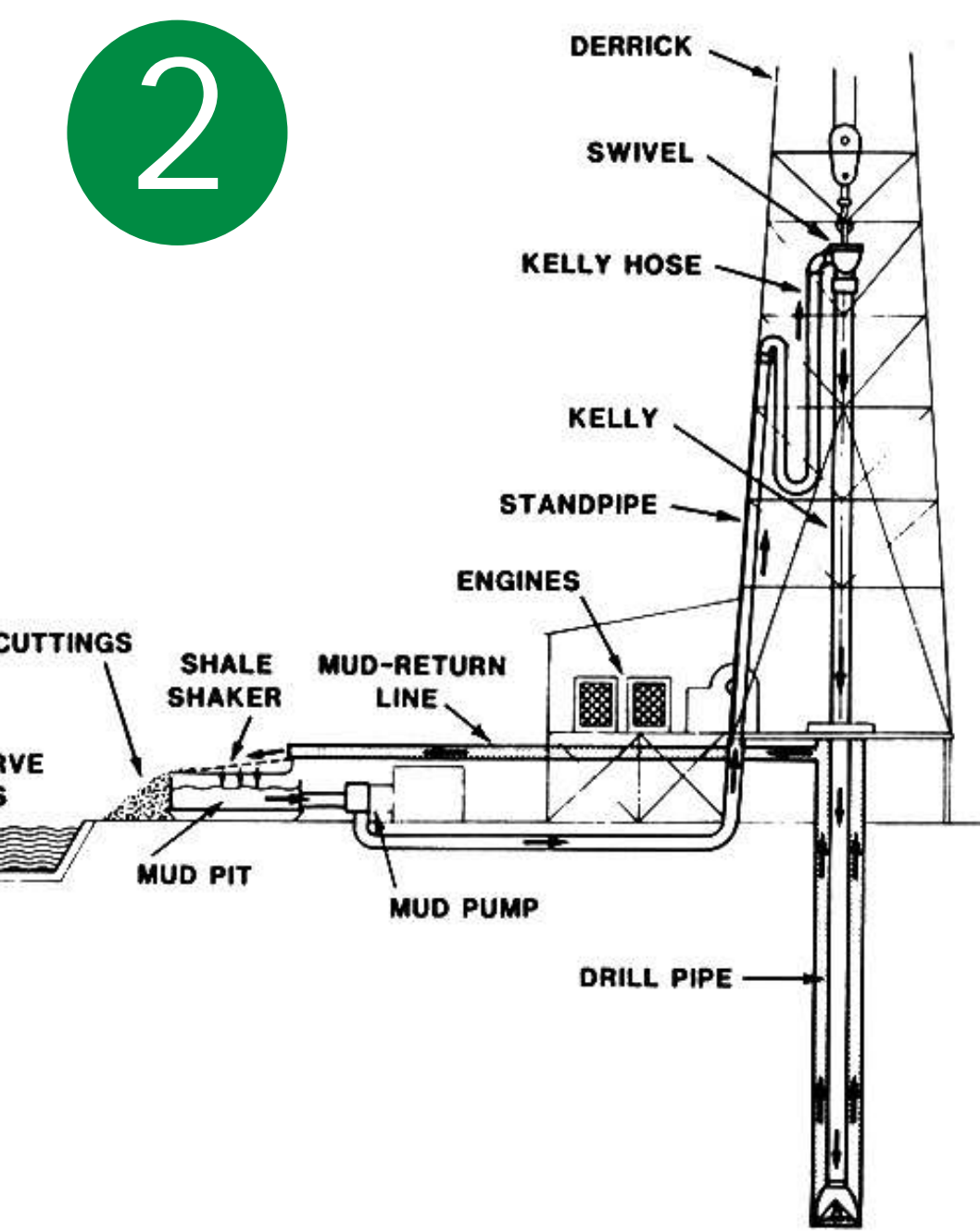
The initial hole is drilled to a depth of 80 to 100 or more feet (24 to 30 or more meters), depending on the surface geology of the area. The hole then is lined with conductor pipe. The space between the casing and the drilled hole (borehole) is filled with cement. This prevents unconsolidated surface formations from sloughing into the hole. The pipe must be set in rock that is capable of withstanding the maximum anticipated pressure to which it may be exposed.



Rotary drilling rig



The rotary drill string and bit physically creates the hole by applying cutting action against the rock at the bottom of the hole.

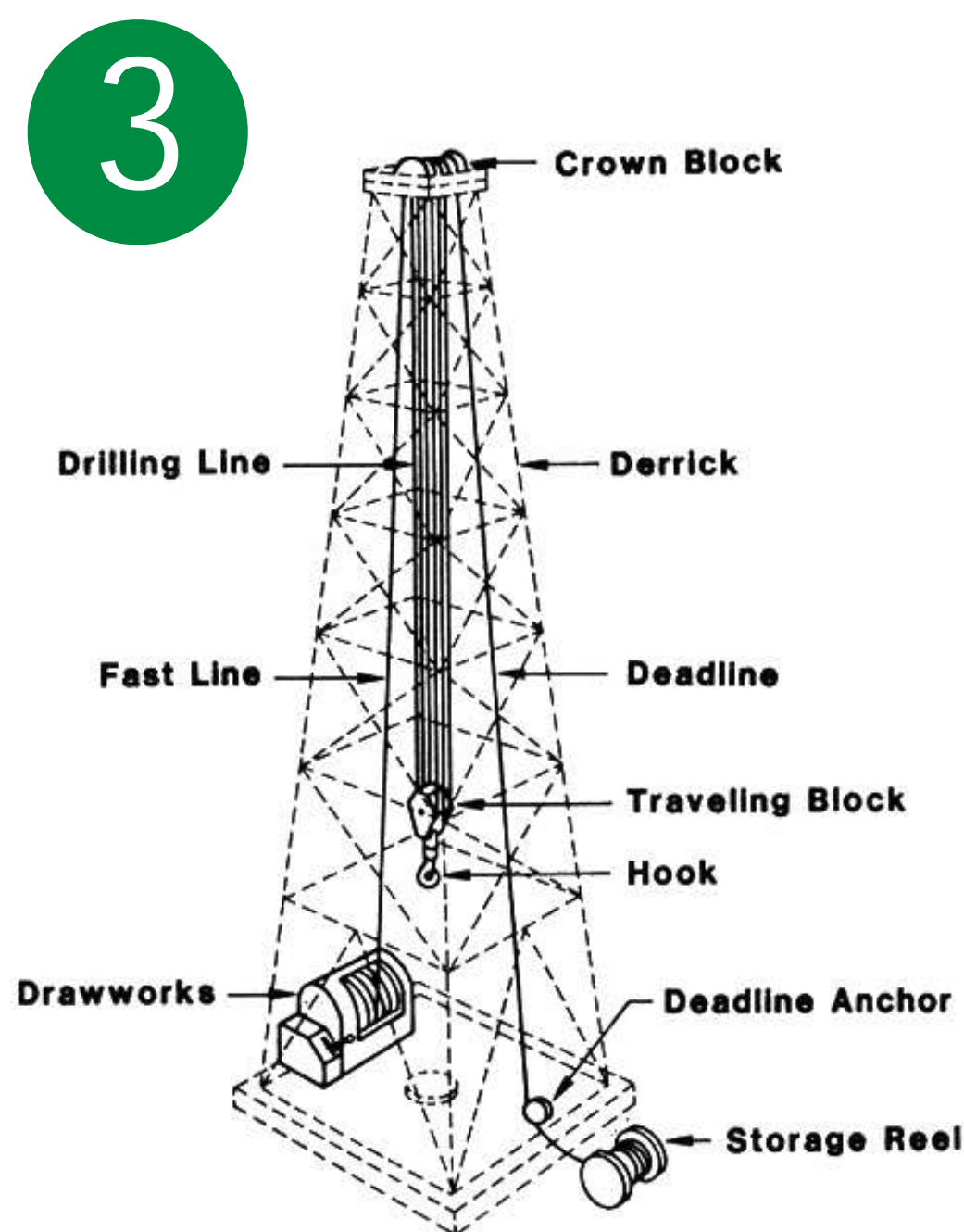


Fluid is continuously circulated down the inside of the drill pipe, through the bottom of the bit, and back up the annular space between the drill pipe and hole to:

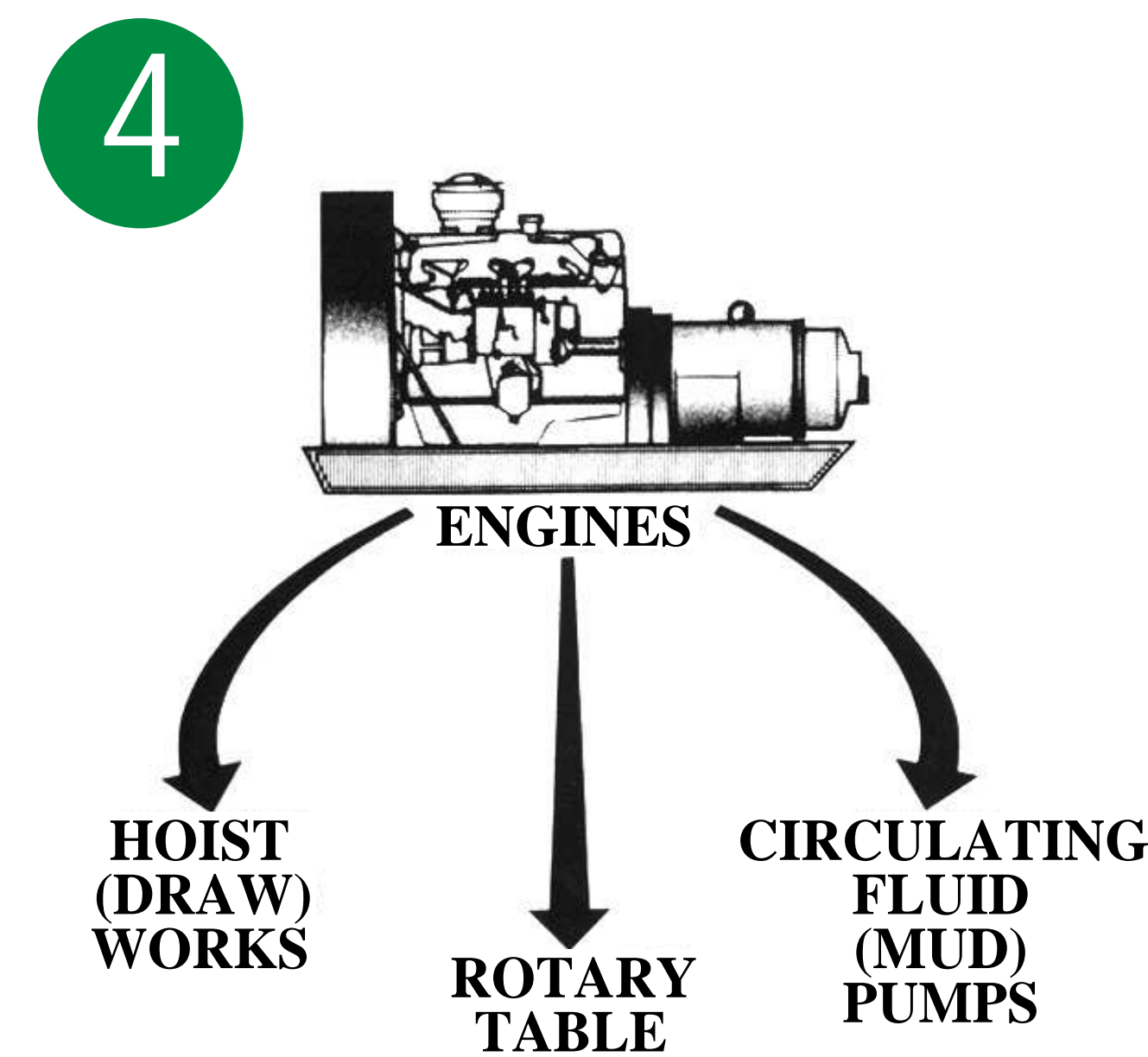
- carry broken rock fragments to the surface
- help counterbalance any high pressures encountered
- contribute to wellbore stability
- lubricate and cool the bit

Five major systems essential to the operation of a rotary rig:

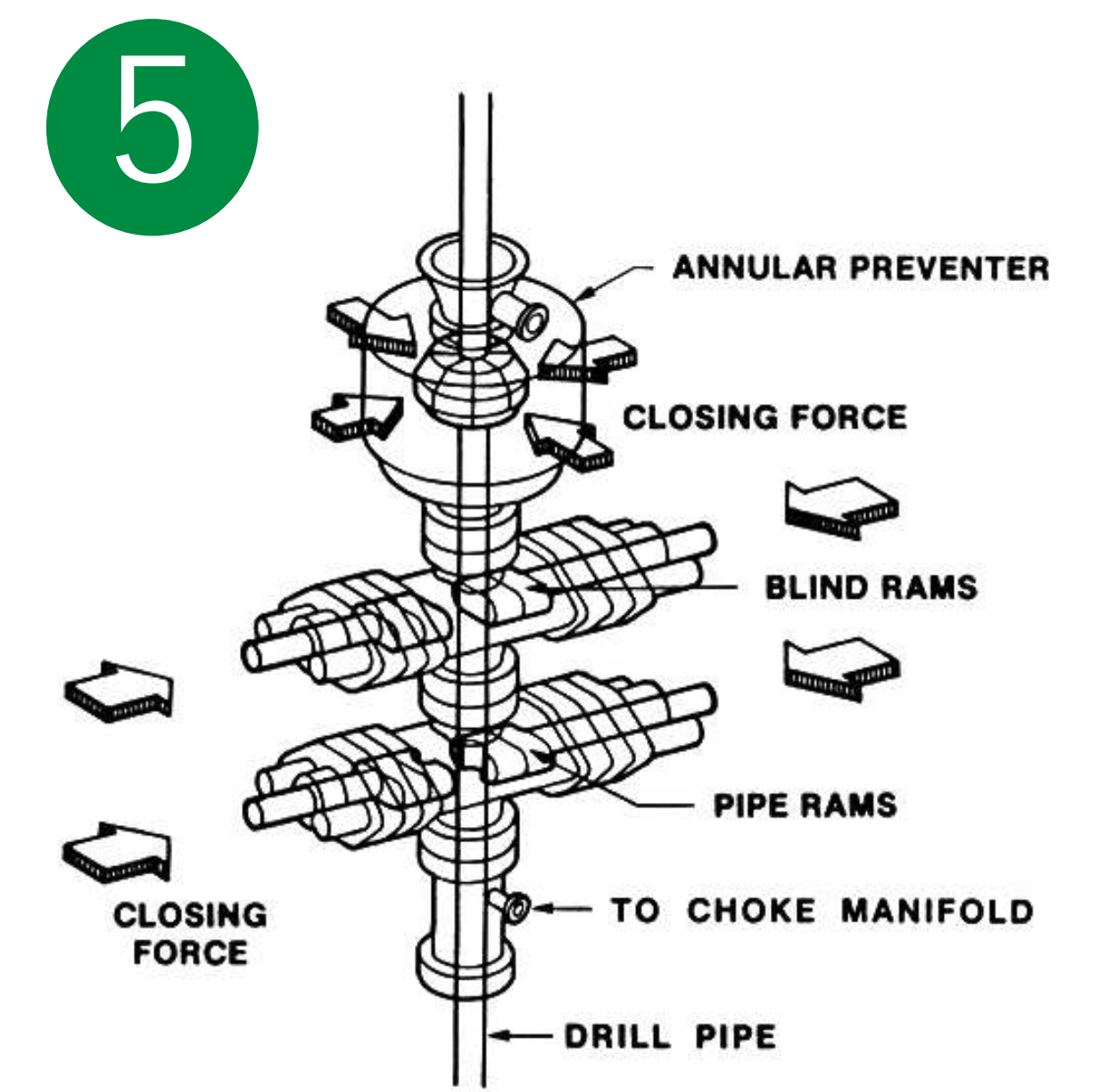
- 1 Drill string and bit system
- 2 Fluid circulating system
- 3 Hoisting system
- 4 Power system
- 5 Blowout prevention system



The rig's hoisting system lifts the drill pipe, drill collars, and drill bit in and out of the hole.



The power system commonly operates the hoist works, rotary table, and fluid circulating system. The engines generally use diesel fuel, and usually a large rig has more than 2,000 horsepower available for operating the equipment.



The blowout prevention system is equipment that prevents high pressure fluids in deep wells from escaping to the surface.

Typical Rotary Drilling

Figure B-3

After the surface casing is in place, a series of blowout preventer (BOP) valves are attached to the well. The valves close down the well in the event the drill bit penetrates rock formations exhibiting extreme pressure zones that could cause unexpected changes in pressure and a well blowout. Special attention is given to the prevention of well blowouts, and most of the equipment used to support the actual drilling operations is for controlling excess pressure that may be encountered in the formations drilled.

Blowout prevention equipment is tested and inspected, which may be witnessed by the rig personnel and BLM. The drill rig crew must be trained in safety and blowout prevention.

Drilling is resumed after installation of casing and the BOP using a smaller bit. After the borehole has penetrated all of the surface formations, which may contain fresh water, the bit and drill string are hoisted out of the well and another length of pipe (surface casing) is lowered into the borehole and cemented in place. The surface casing protects the useable quality water strata (aquifers) from being contaminated by the drilling mud.

Drilling mud (fluid) is circulated through the drill pipe and bit to the bottom of the hole, then up the bore of the well to the surface, possibly across a shell shaker screen that separates the cuttings from the fluid for analysis, while fluid flows. The mud, maintained at a specific weight and thickness, is used to cool the drill bit, lubricate the drill string, seal porous rock zones, prevent blowout or loss of drilling fluid, and transport the cuttings resulting from the drilling to the surface for disposal. Various additives are used to maintain the drill mud at the desired viscosities and weights. Some additives that may be used are caustic, toxic, or acidic. The spent drilling mud and rock chips are disposed in the reserve pit.

Water for drilling is hauled by truck to the rig storage tanks or transported by surface pipeline. Water sources are usually rivers, existing water supply wells, or reservoirs. Occasionally, water supply wells are drilled on or close to the drill site. The operator must obtain a permit from the State for the use of surface water or groundwater from a declared basin for drilling. Water continually is being transported to the well site during drilling operations. Although it will vary significantly from well to well, approximately 10,000 barrels (42-gallon barrels) or an average of 1.25 barrels (52.5 gallons) per foot of water may be required to drill an oil or gas well to the depth of 9,000 feet. If water is hauled by truck, a significant amount of traffic to and from the drill site will be generated by water hauling. More water is required if the underground rocks are fractured and drilling fluids are lost into the formation (lost circulation zone). Uncontrollable loss of drilling fluids may cause drilling to be terminated.

In some areas where drilling must penetrate clay or shale layers, oil-based drilling muds may be used instead of water-based muds after the surface casing has been installed and cemented. The oil-based muds prevent the clays or shales from swelling and caving into the borehole, which can result in the collapse of the borehole making it impossible to pull the bit out of the hole.

An alternate method of drilling, but used only in special cases, is circulating with air instead of mud. To drill with air, large compressors and related equipment are moved onto the site. In drilling, the air is not circulated and used repeatedly; rather, it makes one trip from the compressors, down the drill stem, out the bit, and up the annulus back to the surface, and is blown out a “blooey” line, or vent pipe. Usually, only part of a hole is drilled with air, then the rig is changed over to drilling mud. Among the problems associated with drilling with air, a major limitation is the chance of encountering water.

As the drilling proceeds, additional casings of concentrically smaller diameter are lowered into the well and cemented in place until the final depth (target zone) is reached. During the drilling process, the drill string must be pulled from the well periodically to change the drill bit, replace drill pipe joints, take a drill-stem test (DST), remove core samples, run electrical logs in the wellbore, and install casing in the wellbore. Core samples are analyzed to determine the type of rocks penetrated and their porosity, permeability, chemical properties, and hydrocarbon content.

Drilling operations continue 24 hours a day and 7 days a week. The crews usually work three 8-hour shifts or two 12-hour shifts a day. The greatest amount of human, vehicular, and equipment activity and accompanying noise, etc., occurs during construction and drilling activities. Traffic is generated by trucks hauling equipment and water, service companies delivering supplies and equipment and performing specialized work on the drill rig, drilling crew shift changes, well treatment, and testing equipment, etc.

Upon completion of the drilling, the well is “logged” with down-hole petrophysical instruments and tested to obtain information about the rock formation and production of fluids.

At the completion of drilling, the well is evaluated to determine if hydrocarbons can be commercially produced. Although a DST may have been conducted in a prior zone, a DST may be conducted at this time to measure directly the fluid content (water, oil, or gas) of formation and the amount of flow, as well as any shut-in pressure of the well. The well is logged by measuring the electric resistivity that provides information as to the porosity of the rock, the kind of fluids present, and fluid saturation level of the rocks. These physical characteristics of the rock formations and associated fluids are measured and recorded. If it is determined, based on the tests, that the well can be developed economically for production, the well is readied for production and connected to a gathering system (see Field Development and Production).

Directional Drilling

Although limited in use, directional drilling may be used where the drill site cannot be placed directly over the reservoir, as might be the case where a river or mountain is involved, where no surface occupancy is permitted on the leasehold, or where land use restrictions require centrally located drill sites.

There are limits both to (1) the degree that the wellbore can be deviated from the vertical and (2) the horizontal distance the well can be drilled from the well site to the target zone. The limit of horizontal distance also is affected by depth of the target zone, characteristics of the rock formation to be penetrated, and the additional costs of directional drilling. These factors all are considered before applying this technology.

If oil or gas is not discovered in commercial quantities, the well is considered dry. The operator must comply with BLM procedures for plugging and abandoning a dry hole and reclaiming the well site and possibly associated access roads.

FIELD DEVELOPMENT

The completion of a wildcat well as a commercial producer marks the potential beginning of the development of an oil and/or gas field.

Field Development Plans

A field development plan consists of a coordinated collection of site-specific drilling and surface use plans for individual wells with associated roads and flowlines. The lessee/operator may submit the plan when sufficient information is available to project a reasonably foreseeable development of the field. Sufficient information may not be available until one or more confirmation wells have been drilled to delineate the characteristics of the reservoir. The limits of a field located on a structural trap can be determined more easily than a stratigraphic field based on the information obtained from drilled wells and geophysical data. The proposed field development is subject to environmental analysis prior to approval or rejection of the APD.

The surface plan includes information on existing roads, the proposed location of the access roads, the proposed well or wells, flowlines, tank battery, and any camps, if required; the proposed location and type of water supply; the proposed waste disposal methods; plans for reclamation of the surface; and other information deemed necessary.

The subsurface information required to be submitted includes (1) occurrence and anticipated depths of fresh water aquifers, (2) expected depths of possible oil or gas productive zones above or below the zone already discovered, (3) other mineral-bearing formations, (4) the potential for entering highly permeable formations in which the drilling mud might be lost, (5) the anticipated pressures in the formations to be drilled, and (6) the potential for encountering other geologic conditions that could cause drilling problems. This information is obtained to determine whether the proposed drilling program is adequate, and to ensure the drilling mud, pressure control, casing, cementing, testing, well logging, and completion programs adequately protect the surface and subsurface environments, protect other subsurface resources, and provide safe working conditions.

Well-Spacing Pattern

Before development of an oil and gas field begins, a well-spacing pattern is established to allot a spacing unit for each well that will be drilled in the discovery area. The spacing pattern for drilling wells is set by the government. Oil well spacing patterns in the United States range from 2.5 acres per well to 640 acres per well. Spacing units established for oil production are usually closer than gas well spacings and are generally in multiples of 40 acres (40, 80, 160, 320, 640 acres per well). Gas well-spacing patterns in the United States range from 40 to 1,440 acres per well. Most spacing patterns established at the present time for production of gas are 160, 320, or 640 acres per well.

The well-spacing pattern established for an oil and gas field is the primary factor that determines the amount and intensity of human presence and associated activity during the development and operation of the field. Also, it affects the amount of surface disturbance and land area required to accommodate surface facilities. For example, if the well-spacing pattern is larger, the intensity and concentration of human activity will be lower and less overall surface disturbance will occur.

Unitization

In areas involving Federal lands, a unit consolidation of leases may be formed pursuant to 43 CFR Subpart 3180 through Subpart 3186. The boundaries of the area enclosed within a unit are determined by available geologic data.

A unit agreement provides for (1) development and operation of the field as a single, consolidated unit without regard to separate lease ownership; (2) the allocation of costs and benefits according to terms of the agreement; and (3) a single unit operator. Exploratory units also are formed to share the cost of (1) geologic and geophysical evaluation and (2) drilling exploratory wells to test geologic structures. Unit agreements involving Federal leases require BLM approval.

Leases that are committed to a producing unit are considered producing leases and will not terminate as long as production continues within the unit. As the limits of the productive area are defined by additional drilling, some leases may be dropped from the unit, others may join. If a Federal lease is dropped from a unit, the term of the lease may be extended for a period of two years if less than two years remain in the primary term of the lease.

Field development under an undivided unit agreement reduces the surface use requirements because all wells within the unit boundaries are operated as though they are located on a single lease. Development and operations of the field are planned and conducted by a single unit operator and, therefore, duplication of field processing equipment and facilities is minimized.

Drilling Procedures

The drilling of development wells is basically the same as the drilling of a wildcat well. Roads and other facilities are planned and constructed for long-term use.

Surface Use Requirements

Surface uses associated with oil and gas field development wells include access roads, well sites, flowlines, compressor facilities, storage tank batteries, and facilities to separate oil, gas, and water. In remote locations, worker camps may be required. Access roads are planned, located, and constructed for long-term use as opposed to roads built for short-term use to drill wildcat wells.

Surface Use and Construction Standards

The minimum standards for design, construction, and oil and gas operations are set forth in the Surface Operating Standards for Oil and Gas Exploration and Development “Gold Book.” The Gold Book prescribes the minimum operating standards for oil and gas operations on Federal lands. The objective of the standards is to minimize surface disturbance and effects on other resources, and retain the reclamation potential of the disturbed area. In addition, the Las Cruces Field Office of BLM developed best management practices to be implemented as part of fluid minerals projects on public land within the Planning Area (see Appendix A-III). Also, site-specific construction and design standards and mitigation measures may be required depending on the proposed activities and conditions encountered at the construction site.

The locations for well sites, tank batteries, reserve pits, pumping stations, roads, and pipelines are selected to minimize, to the extent practical, the long-term impacts on other resources and disruption of other land uses. Ideal locations for oil and gas activities are seldom available and avoidance of damage to surface resources is not always possible. Well sites must be located to take advantage of the geologic target sought. Pipelines, because of their linear nature, cannot always be located to avoid all areas exhibiting environmental sensitivity to impacts. Avoidance of construction on steep topography and unstable soils; near streams and other open water areas; on cultural resource sites; and in threatened, endangered, or sensitive species habitats is attempted; however, it is not possible or practical to avoid all situations. Therefore, special construction techniques and operating practices may need to be employed to minimize the impacts.

Oil Field Production Development

Production operations in an oil field begin soon after the discovery well is completed. Portable and temporary facilities may be located on the drill pad are used to initiate the production of oil from the reservoir. As further drilling proceeds and reservoir limits are established, permanent production facilities are designed and installed at centralized locations. The type, size, and number of the facilities are determined by the number of producing wells, expected production rates, volumes of gas and water expected to be produced with the oil, the number of separate leases involved, and whether or not the field is being developed on a unitized or individual lease basis. Development of production on a lease basis requires handling and processing facilities be installed on or near each lease/well.

Gas Field Production Development

Production operations in a gas field begin when a pipeline to a market outlet is constructed. Market pipelines are not economical unless sufficient gas reserves have been proven to exist by drilling operations. Gas wells are often shut-in after completion for periods of several months or years until a pipeline connection becomes available and economical. As gas is transported by pipeline rather than truck, field development includes installation of gathering pipelines, compressor stations, and potential gas plants prior to the transfer to the market pipeline.

Rate of Development

The rate at which development wells are drilled in a newly discovered field depends upon (1) the probability of profitable production, (2) whether the field is developed on a lease basis or unitized basis, (3) the availability of drilling equipment, (4) protective drilling requirements, (5) the degree to which limits of the field are known, (6) operator business practices, (7) availability of investment money to fund development, and (8) market conditions (price of commodity).

A significant factor when determining how fast field development is undertaken is indicated production potential. If large productive capacity and substantial reserves are indicated, development drilling proceeds at a rapid pace. If there is a question as to whether indicated reserves are sufficient and economic to warrant additional wells, the development drilling occurs at a slower pace. An evaluation period to observe production performance may follow between the drilling of each well.

Development on an individual lease basis proceeds more rapidly than development in a unitized area. When development drilling is undertaken on a lease basis, each lessee drills his own well(s) to obtain production from the field. This creates a competitive situation where the first wells drilled potentially produce the greatest share of oil and/or gas from the reservoir and quickest and greatest return on

investment. When unitized, all owners within the “participating area” share in a well’s production regardless of whose lease the well is located on. The development of a reservoir then can proceed in an orderly manner and pace.

Protective Drilling

Drilling of a well to prevent drainage of petroleum to a producing well on an adjoining lease is a common goal of both the lessor and lessee. Preventive drilling may be required in fields that contain a mixture of Federal land and patented or fee land. The terms of Federal leases require drilling a protective well on the leased tract if an “offset” well is located on adjacent non-Federal land or on Federal land leased at a lower royalty rate. An “offset” well is a well drilled at the next location in accordance with the established spacing rule to prevent (or protect) the drainage of oil and gas to an adjoining tract where a well is being drilled or is already producing.

Pool Discoveries

Discovery of a “new pay zone” within an existing field is a “pool” discovery, as distinguished from a new field discovery. A pool discovery may result in the drilling of additional wells—often on the same well pads as currently producing wells, or often sharing the same boreholes or separated only by a few feet. Currently producing wells also may be drilled deeper to the new pay zone. Each new pay zone developed requires additional flowlines, storage, and treatment facilities if the fluids from the various pools are to be kept separate. Some fields contain as many as seven or more pay zones all sharing a geologic structure that created the conditions for the accumulation of oil and gas.

PRODUCTION

Production is a combination of operations that includes (1) bringing the fluids (oil, gas, and water) to the surface; (2) maintaining and/or enhancing the productive capacity of the wells; (3) treating and separating the fluids; (4) purifying, testing, measuring, and otherwise preparing the fluids for market; (5) disposing of produced water; and (6) transporting oil and gas to market.

Production of oil and gas from a single well usually is initiated as soon as drilling and completion operations are completed and the well is developed for production. In the meantime, other wells may be in production, being drilled, or exist only in the field development plans. It may take a few months to several years before a field is fully developed. Therefore, field development activities and those activities normally associated with oil and gas production occur simultaneously during the early life of a field. Drilling of new wells is undertaken periodically throughout the life of a producing field to increase or maintain production from the reservoir.

Well Completions

After a well has been drilled and evaluated for its economic worth and profit, work to set the casing and prepare the well for completion and production begins. The decision to complete an individual well for production is based on the type of oil or gas accumulations involved, the expected future development that may be undertaken during the life of the well, and the economic circumstances at the time that the work is done. Completion equipment and the methods employed vary.

Well completion involves installation of steel casing (production casing) between the surface casing (or last drilling casing) and the oil and gas producing zone. The steel casing then is cemented to provide wellbore stability and protect specific zones (i.e., fresh water aquifers). The casing is perforated at the “pay zone,” which then may be “stimulated” or “treated” to increase productivity.

The drilling rig and most of the support equipment are moved from the well site after the production string or casing is cemented. Small diameter “production” tubing is then placed inside the casing down to the producing zone. The tubing is connected to the surface equipment and transports the oil and gas from the bottom of the well to the surface. If the pressure is sufficient to raise a column of oil or gas to the surface, the well is completed as a flowing well. When pressure is not sufficient, a pumping system is installed. Typically, oil wells require a pumping unit. After the well is completed, the well can be tested for a period of days or months before another well is drilled.

Temporary storage tanks normally are used to hold the produced oil during testing. A “separator” is required to separate the gas from the oil or from produced water. Typically, a well is shut in until it is connected unless the oil well is associated with small amounts of gas uneconomical for hook up and sales. In that case, the gas separated from the oil may be burned off, or flared, as waste until a pipeline connection is available. Temporary flaring is conducted in accordance with NTL-4A, Beneficial Use, for testing purposes. If water is produced with the oil, a “treater” is needed to separate emulsified oil and water.

Well Completion Report

A “Well Completion or Recompletion Report and Log” must be filed with the BLM within 30 days after completion of a well for production. The completion report reflects the mechanical and physical condition of the well. Geologic information and, when applicable, information on the completed interval and production is required. Operators must notify the BLM no later than the fifth business day after a well begins production. The information in these reports may be withheld from the public if the operator requests that it be held as proprietary information.

Well Stimulation

“Well stimulation” is employed to enlarge channels or create new ones in the producing formation rock to enhance oil and gas production. Because oil is usually contained in the pores or fractures in a reservoir formation, enlarging or creating new channels allows the oil or gas to move more freely to a wellbore. A well may be restimulated several times during its lifetime to maintain or increase production. There is a short-term increase in activity at the well site during this process. Generally no new surface disturbance is required to perform these operations. Two basic well stimulation methods are commonly used—treatment and hydraulic fracturing.

Acid treatment dissolves rock with weak hydrochloric acid, thereby enlarging existing channels and opening new ones for oil or gas to flow to the wellbore. Reservoir rocks most commonly acidized are limestone (calcium carbonate) and dolomite, which exhibit low permeability. Well servicing rigs are used to prepare both new and old wells for acid treatment.

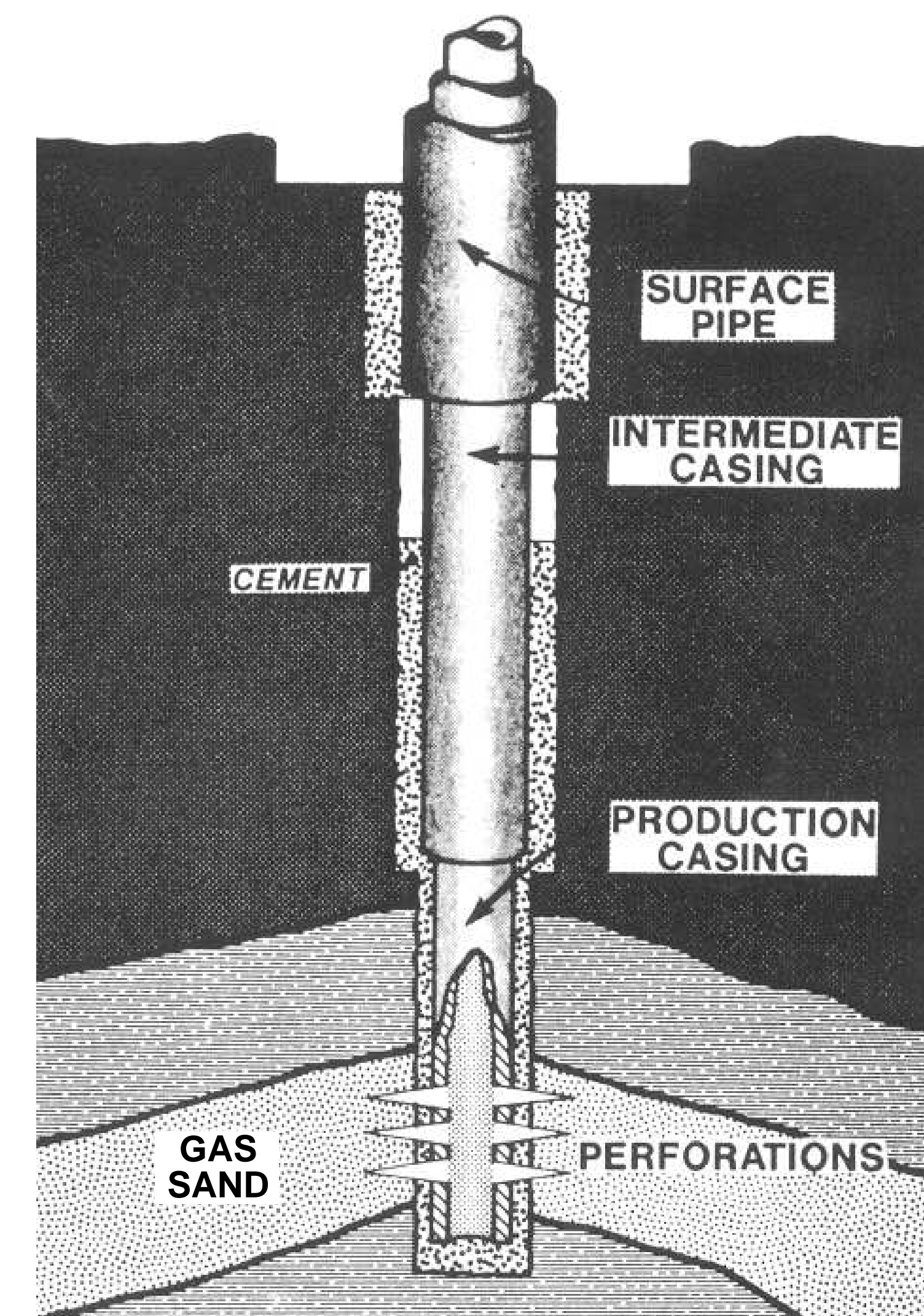
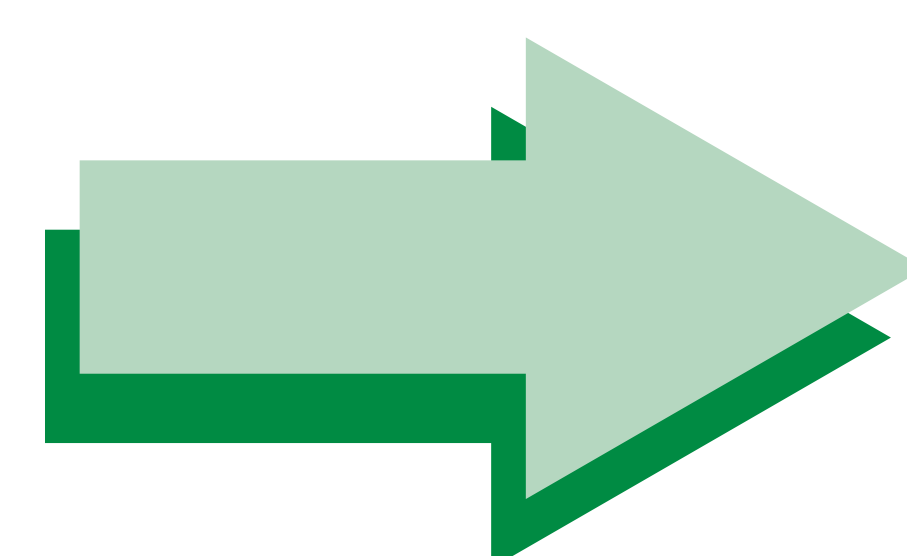
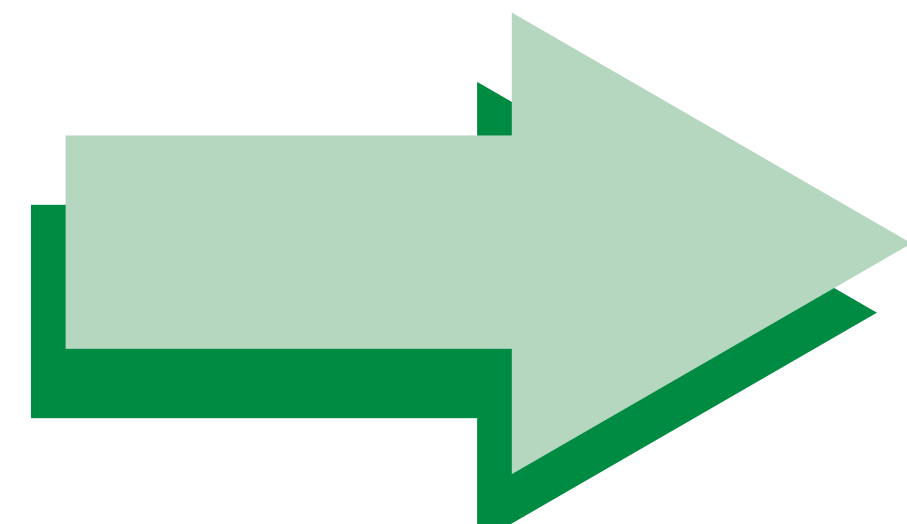
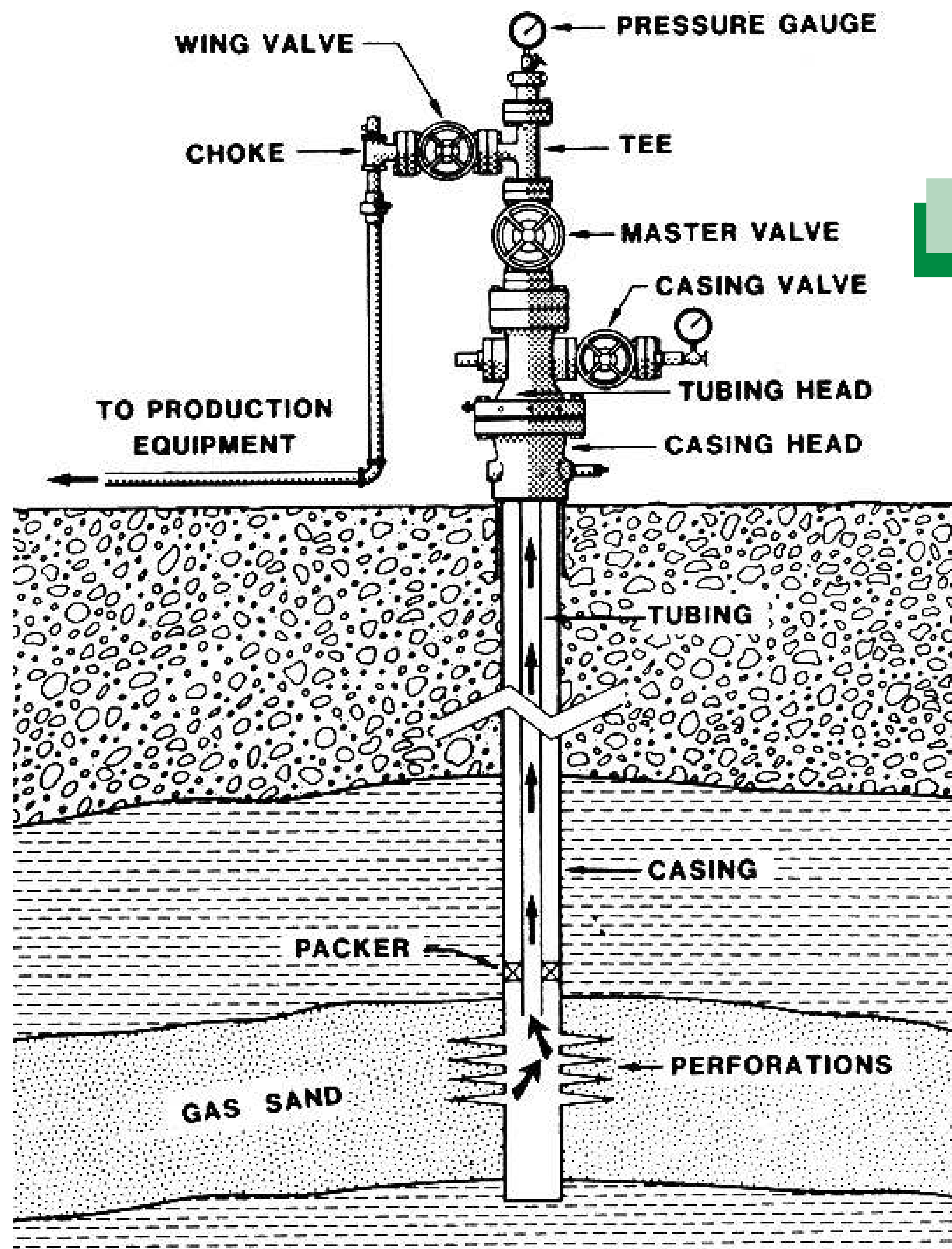
Hydraulic fracturing is used to create or enlarge cracks in sandstone reservoirs in the same manner as acid treatment is used in limestone or dolomite reservoirs. Hydraulic pressure is applied against the formation by pumping fluid, and proppants sand under high pressure, into the well. This pressure splits and cracks the rocks while keeping the fractures open to improve the productivity of the well, or increase the rate fluids that can be injected into disposal wells. Most well pads are of sufficient size to accommodate the trucks and other equipment needed to complete a “frac” job; however, a second pad and additional surface disturbance may be required for safety considerations and to accommodate the large amount of equipment needed to perform special “massive fracture” jobs.

Oil Wells - Wellhead Facilities

The “wellhead” is the equipment installed to maintain control of the well at the surface and to prevent well fluids from “blowing” or “leaking” at the surface. The pressures encountered in the well determine the type of wellhead equipment needed. This varies from a simple assembly to support the weight of the production tubing in the well to a high-pressure wellhead to control reservoir pressures.

Flowing Wells

Surface equipment at the head of a flowing well is limited to a series of valves, or a “Christmas tree,” and possibly a fenced area ranging from 15 feet by 15 feet (5 meters by 5 meters) to 50 feet by 50 feet (15 meters by 15 meters) around the wellhead (Figure B-4). A service area also may contain a small (1 foot by 2 feet by 3 feet) gas-powered chemical pump and “guy line” anchors for servicing units brought in for well repairs. Chemical pumps used to inject emulsion breakers, corrosion inhibitors, or paraffin solvents into the well or flowline may be present.



Casing strings cemented in the hole

Typical Flowing Well

Figure B-4

Artificial Lifts (Pumping)

When a well is completed, the natural reservoir pressure may drive the fluid to the surface. At some time during the life of a well, the pressure is depleted and some form of artificial lift may be used to raise the fluid to the surface. The most common methods of artificial lift are sucker rod pumps, centrifugal pumps, hydraulic pumps, and gas lift. All of the pump systems require some type of surface equipment and a power system. All power systems generate noise; however, this ranges from almost none for electric motors to high noise levels for single cylinder gas engines.

Sucker Rod Pumps

The pumping unit is the most visible and recognizable piece of equipment within oil fields. Pumping units vary in size from 4 feet (1.2 meters) to more than 25 feet (7.6 meters) in height depending on depth of well. The principle of the sucker rod pump is the same as that of the common hand pump used to lift water. A series of rods and a valve move up and down through a “stuffing box” in the well to bring the oil to the surface. The stuffing box is regularly maintained to prevent oil leaks from the wellhead. Failed packing in stuffing boxes is a common cause of oil spills. The rod is connected to a reciprocating pumping unit or “pump jack.” Surface pumping units are usually powered by electric motors; however, internal combustion engines are used when electric power is not available. Single-cylinder engines operate at very high noise levels, whereas multi-cylinder engines operate at lower noise levels and electric motors at a very low noise level.

Centrifugal Pumps

Centrifugal submersible well pumps consist of a stack of 25 to 300 electric-powered small pumps located inside the well casing. Centrifugal pumps require little equipment above the ground and generate no noise at the surface. Surface equipment requirements include a switch or control cabinet, the wellhead, a spool for the cable used to transmit electricity to the pumps, and an electric power line.

Hydraulic Pumps

The pumping unit of a hydraulic system is located inside the well and is powered by oil under high pressure. The equipment required on the surface includes a storage tank for the power oil, a pump to pressurize the oil, an electric motor or internal combustion engine to power the oil pump, power oil regulating valves and pressure gauges, hydraulic pump, and the oil wells. The total surface area used for this type of facility may be greater than for other pumping systems if a centralized power system and additional oil pressure lines are used to carry the power oil from the pump to the wellheads. The noise

level created at the wellhead depends on whether an electric motor or internal combustion engine is used to power the oil pump.

Gas Lift

Gas lift is commonly used where low-cost, high-pressure natural gas is available and where pressure in the petroleum reservoir is sufficient to force the petroleum part of the way up the well. In this system, natural gas under pressure is injected into the well casing. The gas forces the fluids up the production tubing to the surface. The gas pressure maintained inside the casing creates a flowing well. The surface equipment used for gas lift includes a gas compressor, oil storage tank, and separator. The system is quiet if the compressor is powered by an electric motor and little physical space is required at the wellhead.

Gas Wells

Most gas wells produce by normal flow and, in most cases, do not require pumping. Surface use at a flowing gas well usually is limited to a 20-foot by 20-foot (6-meter by 6-meter) area. Formation water may enter a gas well and choke off the gas flow. A pump then is installed to pump off the column of water. Some gas wells may require periodic to almost continual water pumping. The typical gas wellhead facilities are similar to those of a flowing oil well, consisting of a relatively unobtrusive wellhead “Christmas tree” (see Figure B-4).

Oil Field Gathering Systems

Crude oil is transferred in small diameter pipelines called “flowlines” from the wells to treatment facilities and a central tank storage battery before it is transported from the lease. The flowlines may be constructed with 3- or 4-inch-diameter steel pipes, but plastic pipe is more commonly used.

Flowlines may be placed on the surface of the ground or they may be buried. If buried, the installation of flowlines is similar to small-scale pipeline construction.

Generally, a level bed is constructed to provide for vehicle access, trenching, and burial of the flowline. Flowlines often are installed in, or adjacent to, a roadbed to reduce surface disturbance and facilitate its installation.

After the oil is gathered from the field and is treated, measured, and tested, it is transported from the lease by pipeline or trucked to market.

Gas Field Gathering Systems

Natural gas often is sold at the wellhead and transported directly off the lease. If processing and conditioning are required to remove liquid hydrocarbons, and water, the gas may be transferred to a central collection point and treating facility through flowlines prior to sale. Gas gathering systems may include equipment for conditioning and upgrading the gas and compressing the gas so that it flows through the pipelines and all systems have a controller, a measuring device, and recorder for the production flow.

Large compressors are used to compress the gas. Pressures may range from 509 to 1,000 pounds per square inch (psi). Large reciprocating compressors driven by gas engines are used, but centrifugal units driven by gas turbines or electric motors also are used. Large compressor stations along the pipeline often use natural gas from the pipeline for fuel. Storage and maintenance facilities for the gas field's operations usually are located at the compressor station. Compressor stations are the largest and most visible features in a gas field and are the center of most of the human activity.

Oil and Gas Separating, Treating, and Storage Facilities

Fluids produced from a well normally contain oil, gas, and water. The oil, gas, and water are separated or treated before the oil is stored in the tank battery. The treating facilities may be located at the wellhead, but in a fully developed field, they are usually located at a central tank battery site. If enough natural gas is produced with the oil to warrant separation, it will be separated from the fluids, compressed, and transported by pipeline directly to market.

Enough "casinghead gasoline" or "drip gas" may be produced in the field to make it economical to process it for marketing. In that case, a "gasoline" plant may be built in the area to remove natural gasoline, butane, and propane. Some of the residue gas may be used to fuel gas compressors, pump engines, and heat the separating and treating vessels. The remainder of the gas is marketed.

The oil and water produced from a well are usually in the form of an emulsion. Water is separated and removed after the gas is removed. The type of treatment facilities used depends on the amount of emulsification. If emulsification is high, chemical and/or heat treatment is used to separate the oil and water. Heat is applied in a facility called a "heater-treater," which breaks the oil in water emulsification. The heat is supplemented in most cases by chemical emulsion breakers. The oil and water, when not highly emulsified, may be separated by gravity in a tall settling tank called a "gun barrel." Conducting equipment such as separators, heaters, dehydrators, and compressors may be located at the wellhead where the oil and gas first reach the surface or at the tank batteries and/or gas compressor stations in the field.

After the oil and water are separated, the oil is piped to storage tanks (tank batteries). The tank batteries are usually located on, or in the vicinity of, the lease. Tank batteries usually contain at least two tanks. The number and size of tanks and other equipment vary with the rate of petroleum production from the field. Tank battery sites may occupy from 1 to 5 acres depending on associated facilities and number and size of tanks. Often, the well pad is used for setting the tank batteries; however, if tank batteries are located off site, new construction may be needed.

Although natural gas is produced in varying quantities with the crude oil, in many fields the primary or sole production is the natural gas itself. Field processing to upgrade the gas for transportation and marketing consists of two primary treatments. The first is to separate the natural gas from crude oil and/or other liquid condensates including free water. In this process the gas is run through “separators” and/or a “heater” to separate the liquids from the gas. The gas then is run through a “dehydration unit” to remove the remaining water vapor. The removal of the water vapor is important because in the presence of natural gas or other hydrocarbons it will form “hydrates” that precipitate out and cause blockage of pipelines. The treatment of the gas is done either at the wellhead or at a centralized field facility located at the tank battery site or at a compressor plant. No gas is stored at these facilities, but is entered directly into additional gathering or marketing pipeline after treatment.

Hydrogen sulfide (H₂S) and carbon dioxide (CO₂) are “associated gases” commonly produced with the natural gas. H₂S is extremely toxic, heavier than air, highly corrosive to unprotected metal, and will cause eventual failure of the metal. Unless these gases are present in the very small quantities, they must be removed from the natural gas. There are several processes used to remove “acid gases.” The most common is the alkanolamine process in which the gas is absorbed in an alkanolamine solution.

Disposal of Produced Water

After water is separated from oil at the tank battery, it is disposed under BLM approval and supervision. Although most produced waters are brackish to highly saline, some produced waters are fresh enough for beneficial surface use.

Produced water from oil and gas operations is disposed of by subsurface injection, into lined or unlined pits, or other methods acceptable to the BLM, in accordance with the requirements of Onshore Order No. 7. Disposal of produced water by disposal/injection wells requires permit(s) from the primacy State or U.S. Environmental Protection Agency (EPA). In New Mexico, the New Mexico Oil Conservation Division has jurisdiction over water disposal. Approval of surface use by the surface-management agency, if other than the BLM, also is required.

Advantages and disadvantages of the alternative water disposal systems vary. Surface systems (lined evaporation pits) may require an area larger than the tank batteries. Because produced water seldom issues from heater-treaters completely free from oil, oil skimmer pits are installed between the

separating facilities and the evaporation pits. If a skimmer or evaporation pit is accidentally breached, oil and/or produced water spills may occur. Evaporation pits do not work efficiently at high elevations and cool temperatures.

When produced water is disposed underground, it is introduced into a subsurface horizon containing water of equal or poorer quality. Also, it may be injected into the producing zone from which it originated to stimulate oil production. Dry holes or depleted wells may be converted for produced-water disposal. Occasionally new wells will be drilled for this purpose. Well completion requirements for an underground injection well typically are more stringent due to higher pressure requirements. An injection pump is used to force the produced water into the disposal zone. Produced water is prevented from migrating up or down from the injection zone and into other formations in disposal wells.

Secondary and Enhanced Recovery of Oil

Oil, gas, and water typically are trapped within fine rock pores under high pressure in the oil reservoir. The well provides a low-pressure zone in the rock. Expansion of pressurized water and gas in solution forces oil out of the rock pores into the well and up to the surface. This is known as the “primary drive” or “primary recovery.” Oil flowing out of the rock drains pressure from the formation, pressure in the reservoir begins to slowly decline, primary drive diminishes, and the production rate falls. Oil cannot be produced unless pressures within the reservoir are maintained or restored to cause displacement of the oil being held in the rock and to drive it to the wellbore. Usually, only 15 to 20 percent of the oil is recovered from a reservoir during primary production. As reservoir pressures continue to drop, gas in the oil escapes, forming bubbles in the rock pores. Installation and implementation of a secondary and enhanced recovery system significantly increase a field’s productivity and longevity. Many reservoirs are developed for secondary and enhanced recovery early in the life of a field.

Secondary Recovery Methods

Fluid injection is a secondary recovery operation in which a depleted reservoir is restored to production by the injection of liquids or gases (from extraneous sources) into the wellbore. In essence, this injection restores reservoir pressures and moves some of the formerly unrecoverable oil through the reservoir to the well. Secondary recovery can double the total amount of oil produced from a field. Fluids are forced into selected injection wells to force the oil to production or recovery wells nearby. Two of the more common fluid injection methods are waterflood and produced water disposal.

The installation of a secondary recovery system involves drilling of injection wells and new recovery wells or conversion of production wells to injection wells. Fluid injection lines are installed and additional water separation and storage facilities are constructed to implement the secondary recovery

system. Secondary recovery results in a significant increase in the amount of water produced. Additional land area is needed to accommodate water supply facilities, water storage and treating facilities, water injection pumps, and waterlines to wells. Drilling and construction and other human activities intensify in the oil field during installation of a fluid injection system. Water can be appropriated from fresh water sources or be produced water from the formation.

Waterflood

The most commonly employed form of secondary recovery is waterflooding. Water is injected into the reservoir under pressure to drive additional oil to the producing wells. On the average, a successful waterflood doubles the amount of oil recovered from a reservoir. In some fields, water for waterfloods is injected into depleted existing wells. In other cases, additional wells may need to be drilled for water injection. Most waterfloods are difficult to operate on a lease basis, so entire fields, if not already being operated under a unitization agreement, usually are unitized before flooding. If unitization precedes a waterflood, there is little or no duplication of secondary recovery facilities. However, additional surface area is used for the water supply facilities, water storage and treating facilities, water injection pumps, and waterlines to injection wells. If the injection well is a converted producing well, the waterline replaces the producing flowline. If the injection well is a converted dry hole or a new well drilled for the waterflood, the water injection line is the only addition to the pipeline system and requires the same amount of land as a flowline for a producing well. Usually, after a waterflood project is established, additional new water is not needed. The produced water is reinjected.

Although not a secondary recovery process, produced water disposal is a common form of fluid injection. Its primary purpose is simply to dispose of the produced water produced with crude oil. A typical system is composed of collection centers in which produced water from several wells is gathered, a central treating plant in which corrosion-forming substances are removed, and a disposal well. The produced water is injected into the originating zone and used to pressurize and drive the oil towards the borehole of a producing well.

Gas Injection

Gas injection is a secondary recovery technique that is generally used only in oil and gas reservoirs that have an existing gas cap. Natural gas is injected under pressure to restore and maintain reservoir pressures to displace and move oil to the producing wells.

Enhanced Recovery Methods (Tertiary Recovery)

Enhanced recovery methods increase the amount of oil produced and recovered from an oil reservoir beyond that obtained from primary and secondary methods. Enhanced oil recovery techniques employ chemicals, water, gases, and heat either singly or in combination, to reduce the factors that inhibit oil recovery. Considerable technical and financial risk is involved because of the large investment in equipment and the unknown factors or characteristics of the oil reservoir that may affect the success of an enhanced recovery method. There are three broad categories of enhanced recovery methods currently used, namely (1) thermal enhancement, which primarily involves injecting high-pressure steam into the oil reservoir to reduce oil viscosity and increase its ability to flow; (2) miscible flood, in which propane, butane, natural gas, CO₂, or other gases are injected into the reservoir to dissolve and displace the oil; and (3) chemical enhancement, which includes injecting polymers to thicken injected waters to increase uniformity of oil displacement in the reservoir or injecting detergents (“surfactants”) that essentially “wash” the oil from the reservoir rocks.

As with secondary recovery systems, additional land surface is required to accommodate the injection and oil recovery systems. This includes additional wells, injection lines and flowlines, roads, storage and treatment facilities, pumps, and injection equipment.

Transportation Pipelines

A transportation pipeline is commonly used to transport natural gas and oil to market or refineries. In most cases, oil is transported to the refinery via pipeline, although trucks may be used to transport oil from isolated fields or new fields to pipeline terminals or the refinery.

The oil and/or gas is moved through the pipeline by pumps. Pump stations are located either at gathering stations or trunkline stations or a combination of both. A gathering station can be located in or near a field and receives the product through a pipeline gathering system or from tank trucks from the operators’ tanks. From the gathering station, product is relayed to a trunkline station, which is located on the main pipeline, or trunkline. The trunkline station relays the product for processing or shipping terminals. To maintain pressure, booster pumps are spaced along the trunkline. Tank batteries located along the line can receive and temporarily store the product before it continues.

Months and sometimes years of engineering studies and surveys of potential gas reservoirs and markets precede the final decision to build a pipeline.

Construction of a large transportation pipeline may involve as many as 250 to 300 workers in a normal operation and up to 500 workers in a very large operation. The amount of construction equipment needed depends on the variety and difficulty of terrain. Stream crossings, marshes, heavily timbered

forests, steep slopes, or rocky ground can require different types of equipment and construction practices. Crews of 250 to 300 workers can move at a rate of 3 miles a day with a distance of sometimes 10 or 15 miles separating the beginning of the work crew from the end.

In practice, a strip of land from 50 to 75 feet (15 to 23 meters) wide is cleared depending on the size of the pipe and type of terrain. The clearing crews open fences and build gates, cattle guards, and bridges. Salable timber cut by clearing crews is stacked; the rest is cut and disposed. A roadway capable of supporting vehicle access is graded and completed adjacent to the pipeline. The cleared area needs to be wide enough for the pipeline trench, the largest side-boom tractor, and transportation of pipe and equipment. In rocky terrain, a machine equipped with a ripper that extends several feet into the ground often is used to loosen rocks for removal before the ditching operation begins.

A ditch is made by loose-dirt ditching machines or by wagon drills suspended from side-boom tractors. Dynamite blasting is used for very hard rock surfaces. Pipe is transported to the ditching sites where the pipe is coated, double jointed, welded, and lowered into the ditch. The pipe must be buried deep enough to ensure that it does not interfere with normal surface uses. The U.S. Department of Transportation requires a minimum of 36 inches (approximately 1 meter) of cover. The trench is backfilled and compacted; the cleared area is contoured, waterbarred, and revegetated; and the pipeline route is marked.

Well Servicing and Oil and Gas Field Maintenance

Producing wells in active oil and gas fields periodically require repair and workover operations. Operations involving no new surface disturbance to redrill, deepen, and plug-back require prior approval of the authorized officer of the BLM. No prior approval or subsequent report is required for well clean-out work, routine well maintenance, bottom hole pressure survey, or for repair, replacement, or modification of surface production equipment provided no additional surface disturbance is involved.

When prior approval is required, the operator must submit a Sundry Notice or APD as applicable. A detailed written statement of the plan of work must be provided to the authorized officer with the appropriate form. When additional surface disturbance will occur, a description of any subsequent new construction, reconstruction, or alteration of existing facilities, including roads, damsites, flowlines and pipelines, tank batteries, or other production facilities on any lease, must be submitted to the authorized officer for environmental reviews and approvals. Emergency repairs may be conducted without prior approval provided the authorized officer is notified promptly.

Servicing of individual wells to improve or maintain oil and gas production is an activity that extends throughout the life of the field. This work usually is performed with the use of a well-servicing unit or self-propelled workover rig, which is similar to a scaled-down drilling rig although they are commonly truck-mounted. Both the workover rig and well-servicing unit carry hoisting machinery that is used to pull sucker rods and tubing from the wellbore. The most common well-servicing operations include

cleaning out the well, changing pumps, repairing rod string and tubing, changing the producing and re-establishing oil-producing intervals, installing artificial lift, and repairing casing and other downhole equipment. There is an intense, but short-term, increase in human and motorized activity at the well site during servicing.

Construction, reconstruction, and normal maintenance work continue throughout the life of the field. Flowlines, pipelines, pumping units and other oil and gas field equipment, no longer functional because of corrosion, metal fatigue, wear, or because it has become outdated and inefficient, is replaced, upgraded, or abandoned and removed. Major and minor maintenance activities are a normal part of the operations during the life of the oil and gas field.

Pollution Control

All spills or leakages of oil, gas, produced water, toxic liquids or waste materials, blowouts, fires, personal injuries, and fatalities must be reported by the operator to the BLM and the surface-management agency, if other than the BLM. The BLM requires immediate reporting of all major undesirable events (more than 100 barrels of fluid/500 thousand cubic feet of gas released or fatalities involved). A spill prevention, control, and countermeasure (SPCC) plan is required only for wells that have the potential to discharge into waters of the United States.

Firewalls/containment dikes must be constructed and maintained around all storage facilities/batteries. The containment structure must have sufficient volume to contain, at a minimum, the entire content of the largest tank within the facility/battery, unless more stringent site-specific protective requirements are deemed necessary by the authorized officer.

Inspection and Enforcement

The BLM has developed procedures to ensure regular inspections (at least once a year) on leaseholds that are producing or expected to produce significant quantities of oil or gas in any year, or have a history of noncompliance. Other factors such as health, safety, environmental concerns, and potential conflict with other resources also determine inspection priority. Inspections of leasehold operations ensure compliance with applicable laws, regulations, lease terms, Onshore Oil and Gas Orders, notices to lessees, other written orders of the authorized officer, and the approved plans of operation.

ABANDONMENT

All abandonments, whether they involve one wildcat well, a well no longer productive, or an entire leasehold, require the approval and acceptance of the abandonment of the individual well(s) by the

BLM. An acceptable abandonment includes plugging the wellbore and reclaiming the land surface to a stable and productive use.

Approval of Abandonment

Well abandonment operations may not commence without prior approval of a “Sundry Notices and Reports on Wells” by the authorized officer of the BLM. The Sundry Notice serves as the operator’s Notice of Intent to Abandon (NIA). In the case of newly drilled dry holes, failures, and in emergency situations, oral approval may be obtained from the authorized officer followed by written confirmation. In such cases, the surface reclamation requirements will have been discussed with the operator and stipulated in the approved APD. For older existing wells that do not have an approved SUPO, a reclamation plan must be submitted with the NIA. Reclamation requirements are part of the approval of the NIA. The operator must contact the BLM prior to plugging a well to allow for approval and witnessing of the plugging operations.

Plugging of Wells

The purpose of plugging a well is to prevent fluid migration between zones within the wellbore, protect aquifers of useable quality water, protect other minerals from damage, and assist in the reclamation of the surface area. Well plugging requirements vary with the characteristics of the rock, geologic strata, well design, and reclamation requirements. For wells no longer capable of production, all perforations must be isolated so as not to allow fluid to migrate up hole or the surface or to allow migration downward. The perforations may be isolated by (1) placing a cement plug across the perforations and that extends 50 feet (15 meters) above and below the perforations, or (2) setting a cement retainer (cement tool that acts like a plug except that cement can be pumped below the tool but no fluid can pass above the tool) plus or minus 100 feet (30 meters) above the perforations and pumping a sufficient volume of cement into the perforations, or (3) setting a bridge plug (a tool similar to a cement retainer except that no fluid can pass in either direction) plus or minus 100 feet (30 meters) above the perforations and placing 50 feet (15 meters) of cement on top of the bridge plug. The production casing may be removed. If the casing is cut and removed, the casing stub (the top of the casing remaining in the hole) must be plugged with a 100-foot cement plug to extent 50 feet (15 meters) inside the casing stub and 50 feet (15 meters) outside the casing stub (open hole). If casing is not removed, the surface casing shoe must be isolated by perforating the production casing near the surface casing shoe. A cement retainer must be set plus or minus 100 feet (30 meters) above the perforations and a sufficient volume of cement pumped below the retainer, through the perforations, and between the outside of the production casing and the inside of the surface casing for a distance of 100 feet (30 meters). All cement plugs must have sufficient volume to fill 100 feet (30 meters) of hole plus an additional volume of 10 percent per 1,000 feet of depth (a 100-foot plug at 5,000 feet would be required to have an additional 50 feet [15 meters] of cement). At the surface, all annular spaces must be plugged with at least 50 feet (15 meters) of cement.

The operator's plan for plugging and abandonment is submitted with the NIA and is reviewed for completeness and adequacy. Although the plugging of each well must be designed individually, the minimum requirements are described below.

In open hole situations, cement plugs must extend at least 50 feet (15 meters) above and below zones with fluid that has the potential to migrate, zones of lost circulation (this type of zone may require an alternate method to isolate), and zones of potentially valuable minerals. Thick zones may be isolated using 100-foot plugs across the top and bottom of the zone. In the absence of productive zones and minerals, long sections of open hole may be plugged by placing plugs every 3,000 feet. In cased holes, cement plugs must be placed opposite perforations and extend 50 feet (15 meters) above and below except where limited by plug back depth (see Onshore Oil and Gas Order No. 2).

A permanent abandonment marker is required on all wells unless waived. This marker pipe is usually 4 feet above the ground and embedded in cement at the borehole site. The pipe is capped and the well's identity and location permanently inscribed.

Dry wildcat and development wells normally are plugged before the drill rig is removed from the well site. This allows the drill rig to plug the hole and avoid the necessity of bringing in other plugging equipment.

Before a lessee/operator abandons a well no longer capable of production, it must be shown that it is no longer suitable for profitable operation. Wells are normally plugged when they are no longer capable of production. However, if a well has potential for use in a secondary recovery program, it may be allowed to stand idle. Truck-mounted equipment is used to plug former producing wells.

Surface Reclamation

A reclamation plan is a part of the SUPO. Reclamation may be required of any surface previously disturbed that is not necessary for the continued well or other operations. When abandoning a well and other facilities that do not have a previously approved reclamation plan, a plan must be submitted with an NIA. Additional reclamation measures may be required based on the conditions existing at the time of abandonment. Any additional reclamation requirements are made part of the conditions of approval of the NIA. The general standards and guidelines for reclamation and abandonment of oil and gas operations are set forth in the Surface Operating Standards for Oil and Gas Exploration and Development "Gold Book." Additional standards and requirements may be applied to accommodate the site-specific and geographic conditions of the reclamation site (see Appendix A-III).

Inspection and Final Abandonment Approval

Final abandonment is not approved until the surface reclamation work required by the APD or NIA is completed and the required reclamation is acceptable to the BLM or appropriate surface-management agency or private surface owner. The operator must file a Subsequent Report of Abandonment following the plugging of a well. A Final Abandonment Notice, which indicates that the site is ready for inspections, must be filed upon completion of reclamation.

Release of Bonds

A lease bond is terminated only if the well to be abandoned is the last or only well on the lease, and there are no other outstanding liabilities (e.g., unpaid royalties, rents, penalties, etc.).

APPENDIX B-II
STANDARD OPERATING PROCEDURES FOR EXPLORATION,
DEVELOPMENT, PRODUCTION, AND ABANDONMENT—
GEOHERMAL

Geothermal energy is heat (thermal) derived from the earth (geo). In New Mexico, geothermal energy is defined as a mineral. Thus, a geothermal developer must hold geothermal mineral rights for property on which geothermal resources are being produced. Additionally, if that geothermal energy is conveyed to the surface via groundwater, the developer also must have or acquire the appropriate water rights for the use of the groundwater. Because the heat is considered the mineral, the right to use or consume the groundwater is not conveyed with the lease in declared underground water basins. The State Engineer of New Mexico certifies and licenses the rights to beneficially use water in the declared underground water basins of New Mexico.

Once a lease for the mineral rights and the certificate and license to appropriate groundwater are issued, the lessee or developer may enter the leasehold to conduct operations unless otherwise limited by special stipulations. Similar to oil and gas exploration, geothermal exploration can include many activities for which the lease or water right does not have to be obtained. However, just as in the oil and gas industry, if a lease position and water rights cannot be acquired, exploration expenditures probably will not occur. An exploration permit is required for any exploration operations as defined in 43 CFR 3200.1.

The following discussion depicts what can be expected to occur, and is assumed will occur for the purposes of this analysis, when geothermal resources are discovered and development of a lease is undertaken. It also is assumed that the technology of geothermal exploration and development will not change significantly during the life of this document. This section is an integral part of the assumptions made in Chapters 2 and 4 of this document.

Successful exploration and development generally progresses through four basic operational phases. These include (1) preliminary exploratory investigation, (2) test drilling, (3) development/production, and (4) abandonment, which are described below.

PRELIMINARY EXPLORATORY INVESTIGATIONS

Preliminary exploratory investigations can be conducted from either the air or the surface. A lease is not required to conduct these investigations for Federal geothermal resources; however, some surface exploration methods such as seismic or shallow temperature surveys must be reviewed and approved by the surface-management agency. Any of these investigations also can be conducted after lease acquisition.

Airborne exploration can include gravity surveys, magnetotelluric surveys, seasat radar images, and other remote sensing techniques. Surface exploration methods include geologic mapping, heat flow and thermal conductivity surveys, resistivity and self-potential surveys, trace element geochemical and soil surveys, and seismic surveys. Most of these investigations involve only casual use (e.g., with little or no disturbance to the surface or resources) and no permits are required. Generally, the surveys are conducted using existing roads and trails. However, investigators must comply with the rules and regulations of the appropriate surface-management agency. The geothermal lease does not grant an exclusive right to conduct exploratory investigations. Exploratory activities may be conducted prior to or after leasing lessee by or someone other than the lessee. These investigations may result in an expression of interest to lease specific areas.

An exploration permit is required for any exploration operation except under the following conditions as defined in 3250.10 (b): on unleased land administered by a Federal agency other than the Bureau of Land Management (BLM), for unleased geothermal resources underlying surface land that is managed by another Federal agency, on privately owned land, or involving casual use activities (as defined in 3200.1 as activities that ordinarily lead to no significant disturbance of Federal land, resources, or improvements). Exploration operations are defined in part as any activity relating to the search for evidence of geothermal resources where the explorer is physically present on the land and the activities may cause damage to those lands. Exploration operations do not include the direct testing of geothermal resources or the production or utilization of geothermal resources. A developer must comply with 43 CFR Subparts 3250 through 3256. To acquire a exploration permit, the developer must follow the information required in 43 CFR 3251.

Many of the exploration methods used for geothermal exploration also are used for oil and gas exploration and have been described in Appendix B-I. The temperature survey, however, is more specific to geothermal exploration.

A temperature gradient survey, or heat flow survey, is conducted by drilling up to 30 small-diameter wells. Typically these wells are drilled at a density of one well per township. The wells can be drilled with mud, foam, or air rotary to depths between 250 to 450 feet (76 to 137 meters) deep. The wells are typically completed by placing polyvinyl chloride (PVC) casing into the wellbore and filling the casing with water. Typically one well a day can be drilled and set. Once all wells are completed, the temperature gradients in the wells are measured. Upon completion of the survey, the casing is removed and the well abandoned in accordance with State Engineer's Office regulations and the exploration permit requirements. Additionally, well pads and roads are abandoned and reclaimed in accordance with the exploration permit requirements. All reports and notices must comply with 43 CFR 3253 and applicable portions of 43 CFR 3250 through 3256.

TEST DRILLING

If the preliminary exploration program indicates high potential for geothermal resources in a specific area, test drilling may be conducted. Because geothermal energy must be used at the well location, not only must the geothermal potential be present, but its end use must be identified in order to justify drilling the test well. Test wells provide subsurface data, locate potential productive zones, delineate the reservoir limits, and aid in determining the properties of the reservoir and reservoir fluids. These test wells are very similar to oil and gas exploratory drilling with the exception that a geothermal test well is much shallower—1,000 feet (305 meters) at the deepest and typically 100 to 500 feet (30 to 152 meters).

While the test well is drilled for the purposes of “testing” the geothermal prospect, its location usually is selected with production in mind as well. Because of the high temperature and corrosive nature of geothermal fluids and the hard rocks found in geothermal environments, geothermal drilling is difficult and expensive. Each well can cost up to \$1 to 4 million. Drilling costs account for one-third to one-half of the cost of a geothermal project (Utah Energy & Geoscience Institute, University of Utah, website www.egi.utah.edu, 1999).

Test well drilling is authorized by a Federal oil and gas lease, but cannot be conducted unless an operations plan and a drilling program are approved. Operations must be in compliance with all of 43 CFR Subpart 3260 et al. to drill and test geothermal resources. Additionally, the developer must appropriate the groundwater in the declared underground water basins by submitting an Application to Appropriate to the State Engineer.

Proposed construction and other operations that involve surface disturbance conducted under the terms of a lease must be approved by the appropriate surface-management agency before such activities are mitigated. Regardless of the surface-management agency with jurisdiction over the proposed site, the proposed drilling, development, and production operations also must be approved by the BLM.

An application for permit to drill (APD) must include (1) an operation plan (surface use program) and (2) a drilling program. The detailed information that is required to be submitted under each plan/program is identified in 43 CFR 3261.12 and 3261.13, respectively. An onsite inspection of the proposed well site, road location, and other areas of proposed surface use is conducted prior to approval. The inspection team includes BLM representatives, the lessee or developer, principal drilling and construction contractors, and other relevant parties. The purpose of the onsite inspection is to identify problems and potential environmental impacts associated with the proposal and the methods for mitigating those impacts. These may include making adjustments to the proposed well site and road locations, identifying the construction methods to be employed, and identifying reclamation standards for the lands after drilling.

The surface-management agency is responsible for preparing the environmental documentation to satisfy requirements of the National Environmental Policy Act and associated regulations, and may provide mitigation measures as needed to protect surface resource values for APD approvals. The BLM is responsible for approval of the drilling program, protection of groundwater resources, and final approval of the APD. When final approval is given by BLM, the developer may commence construction and drilling operations.

Other proposals to occupy the surface that involve surface disturbance, but are not associated with drilling a well, also must receive advance approval under the procedures described above.

Application to Appropriate

If the test well is to be drilled within the boundaries of a declared underground water basin, an application to appropriate must be filed with the State Engineer in accordance with the “Rules and Regulations governing drilling of wells and appropriation and use of ground water in New Mexico.” The application must state the annual amount of water to be appropriated and its intended use, as well as well location and construction and driller information. The application is reviewed to ensure the water is available, the appropriation will not impair existing water rights or impact public welfare, and/or meets water conservation requirements. Upon receipt of an acceptable application, the State Engineer publishes, at the applicant’s expense, a public notice in a newspaper of general circulation in the county in which the well is located at least once a week for three weeks. Protests can be filed with the State Engineer’s office up to 10 days after the date of the last publication of the notice. All valid protests will be heard by the State Engineer’s Office and the application will be approved or denied. The applicant can appeal the denial. Applications may be approved with conditions.

As soon as practicable after completing the well and the application of water to the intended use pursuant to the permit, the developer must prepare and file a Final Inspection and Report to the State Engineer’s Office in accordance with the Rules and Regulations. Upon receipt of the Final Inspection and Report together with the required attachments, the State Engineer will issue to the developer a Certificate and License to Appropriate.

Surface Requirements and Construction

The well site is selected on the basis of prior surface investigations, prospect location, end use requirements, topography, accessibility, requirements of lease stipulations, and protection of surface resources.

Rights-of-way are required for all facilities, power lines, and access roads that occupy Federal land outside the lease. When a third party (someone other than the lessee/developer or the Federal

government) constructs a facility or installation on or off the lease, a right-of-way also is required. The right-of-way is issued by the surface-management agency. Upon approval of the APD, the construction equipment may enter the leasehold. The types of construction equipment used include dozers (track-mounted and rubber-tired), scrapers, and motor-graders.

In general, the surface requirements and construction of a geothermal well site is similar to an oil and gas well site with the exception that the site may be smaller given the depth of the geothermal well relative to its oil and gas cousin. However, it is not uncommon for geothermal wells to have multiple-well sites as spacing requirements are very different than that for oil and gas resource development.

Drilling Operations

Drilling activities usually begin within a week after the well site and access road have been constructed. Although geothermal well depth is much shallower than an oil and gas well, most of the operation is very similar but scaled appropriately for the depth of the well.

A series of blowout preventer valves are attached to the well. The valves close down the well in the event the drill bit penetrates rock formations exhibiting extreme pressure zones that could cause unexpected changes in pressure and a well blowout. Special attention is given to the prevention of well blowouts and most of the equipment used to support the actual drilling operations is for controlling excess pressure that may be encountered. Blowout prevention equipment is tested and inspected by both the rig personnel and BLM. The drill rig crew must be trained in safety and blowout prevention.

All drilling activities and well completion operations would be conducted in accordance with the drilling program and operations plan. The well would include strings of steel pipe (i.e., casing) to line the well and prevent percolation of drilling mud or geothermal fluids into any geologic formation or freshwater aquifers above the geothermal reservoir zone. Production wells would have perforated casing or open hole completions in the geothermal reservoir zone to allow geothermal fluids to enter the well. The geothermal injection well, if installed, would be drilled and completed with multiple telescoping strings of steel casing, each cemented in place. Shallow groundwater that could be encountered during well drilling operations would be protected from commingling with deeper geothermal fluids through implementation of an approved casing and cementing program. All drilling and casing programs must be approved by the BLM as part of the APD's drilling program. Downhole production equipment (such as pumps) would be used to bring the geothermal waters to the surface.

The sumps (equivalent to the reserve pit in the oil and gas well) are typically reclaimed after drilling. Any portion of the well pad that is not used during production also is reclaimed. If the well is determined to be inadequate for the need, the well is abandoned and the well site reclaimed in

accordance with 43 CFR Subpart 3263. All reports on the drilling operations must comply with 43 CFR Subpart 3264 and conditions of the APD approval.

DEVELOPMENT/PRODUCTION

Production well pads may be single-well or multiple-well pads depending on the resource availability and needs. Each wellhead temperature and pressure is monitored during operation. The facility plan is approved by the BLM and must comply with 43 CFR 3270 through 3279. The facility must be designed to operate safely and protect the environment.

Given the low temperature of the potential geothermal resources in the Planning Area, the potential end uses may include but are not limited to space heating of greenhouses, direct water use or pool heating for aquiculture, and drying in dairy production. Associated impacts depend on the traffic and size of the facility. Greenhouses and aquiculture could range in size of 1 to 30 acres. In general greenhouses employ 8 to 10 persons per acre.

ABANDONMENT

If a well or facility is determined to be no longer adequate for the need, the well is abandoned and the well site reclaimed in accordance with 43 CFR Subpart 3263. All other applicable requirements of 43 CFR 3200 et al. regarding reclamation and reporting also must be met.

APPENDIX C
SUMMARY OF DECLARED AND UNDECLARED UNDERGROUND BASINS

Underground Basin	Aquifer Occurrence	Depth to Water	Well Yields	Dominant Chemical	Water Quality¹	Recharge	Discharge	Problems
Undeclared Basin	Bone Spring Limestone; Basin-fill Alluvium	Crow Flats: <200 feet (61 meters); Upland areas: >400 feet (122 meters); Southwestern section: >500 feet (152 meters)	Bone Spring Limestone: 350 to 3,620 gpm	Sulfate	Bone Spring Limestone: Hardness: 885 mg/L (avg.); Low to moderate salinity Basin-fill: Hardness: 353 to 2,500 mg/L; Saline water; High Sulfate, Chloride, and Nitrate levels	Basin-fill: precipitation (flash floods); Bone Spring Limestone: precipitation where formations are exposed at surface	Basin-fill: evaporation from alkali flats	Declining water levels in Crow Flats due to withdrawals; possible water quality deterioration from alkali flats due to withdrawals; impotable water in basin-fill aquifer
Rio Grande Basin	Santa Fe Group (basin-fill); Valley-fill (floodplain, channel deposits); Mountains (igneous, volcanic, sedimentary units)	Santa Fe Group: <500 feet (152 meters); Valley-fill: <30 feet (9 meters)	Valley-fill: >300 gpm	Sulfate, Chloride, Sodium Bicarbonate, Calcium Magnesium Bicarbonate	Valley-fill: Hardness: >180 mg/L; TDS (average); Basin-fill: Hardness: 120 to 180 mg/L; Freshwater from 10 to 3,500 feet in places; Saline water very deep and at edge of aquifer	Santa Fe: precipitation (flash floods), percolation from perennial streams; Valley-fill: precipitation, movement from Rio Grande	NA	Valley-fill and Basin-fill: contamination with nitrates, ammonia, salinity, organic compounds, and petroleum products

APPENDIX C
SUMMARY OF DECLARED AND UNDECLARED UNDERGROUND BASINS

Underground Basin	Aquifer Occurrence	Depth to Water	Well Yields	Dominant Chemical	Water Quality¹	Recharge	Discharge	Problems
Lower Rio Grande	Santa Fe Group (Basin-fill); Valley-fill (floodplain, channel deposits); Mountains (igneous, volcanic, sedimentary units)	Santa Fe Group: <500 feet (152 meters); Valley-fill: <30 feet (9 meters); Small area just east of Caballo Mountains: >500 feet (152 meters)	Valley-fill near Truth or Consequences and Caballo Reservoir: 100 to 300 gpm	Sodium Bicarbonate, Sulfate, Calcium Magnesium Bicarbonate	Basin-fill: Hardness: 120 to 180 mg/L; Freshwater from 10 to 3,500 feet; Saline water very deep and at edges; Valley-fill: Salinity: 681 mg/L TDS (average); Nitrates	Santa Fe: precipitation (flash floods), percolation from perennial streams; Valley-fill: precipitation, movement from Rio Grande	NA	Valley-fill and Basin-fill: contamination with nitrates, ammonia, salinity, organic compounds, and petroleum products
Hot Springs Basin	Igneous, volcanic, sedimentary units in mountains; Santa Fe Group (basin-fill); Valley-fill; Pennsylvanian and Permian Units	Valley-fill: <10 feet (3 meters); Basin-fill: <500 feet (152 meters); Extreme west side of Black Mountains: >500 feet (152 meters)	NA	Calcium Magnesium Bicarbonate	Valley-fill: Sulfate: 52 to 334 mg/L; Chloride: 90 to 470 mg/L	NA	Valley-fill: Rio Grande	Mixing of thermal and nonthermal waters

APPENDIX C
SUMMARY OF DECLARED AND UNDECLARED UNDERGROUND BASINS

Underground Basin	Aquifer Occurrence	Depth to Water	Well Yields	Dominant Chemical	Water Quality¹	Recharge	Discharge	Problems
Las Animas Creek Basin	Igneous, volcanic, sedimentary units in mountains; Paleozoic Units; Santa Fe Group; Valley-fill	Valley-fill: shallow water table; Santa Fe Group and Paleozoic Units: <500 feet (152 meters); Western side of mountains: >500 feet (152 meters); along Las Animas Creek drainage area: 2 to 355 feet (.61 to 108 meters)	NA	Calcium Magnesium Bicarbonate	Salinity: 0 to 500 mg/L (TDS)	Santa Fe, Valley-fill: precipitation on drainage areas	Valley-fill: downstream water movement to springs	Construction of diversion ditches, wells, and Caballo Dam have modified the hydrologic cycle; well drawdown
Tularosa Basin	Basin-fill (bolson-fill); Alluvium on mountain slopes; Sedimentary units in northern section; Mountains (igneous, volcanic, or sedimentary units)	Alluvium: shallow water table; Basin-fill: <500 feet (152 meters); Mountains on east and west sides of basin: generally >500 feet (152 meters); Tularosa-Alamogordo area: 19 to 172 feet (6 to 52 meters)	High on alluvial fans just west of the Sacramento Mountains: 300 to 1,400 gpm; central part of basin and toes of alluvial fans: <100 gpm	Sulfate, Chloride; Small area near WSMR: Sodium Bicarbonate	Basin-fill: Hardness: 300 mg/L; Salinity: 500 to 1,000 mg/L (TDS); East side of basin: Salinity: 1,000 to 4,000 mg/L (TDS); Central basin: Salinity: 35,000 mg/L (TDS); Sulfate: 250 to 500 mg/L; Chloride: high levels	Alluvium: precipitation and infiltration; Basin-fill: floodwaters infiltrating from westward flowing streams; Sedimentary units: precipitation and infiltration in upland areas through fractures and vugs	NA	Impotable, saline water due to evaporation of salts in the basin; Freshwater only on east and west sides of south part of basin

APPENDIX C
SUMMARY OF DECLARED AND UNDECLARED UNDERGROUND BASINS

Underground Basin	Aquifer Occurrence	Depth to Water	Well Yields	Dominant Chemical	Water Quality¹	Recharge	Discharge	Problems
Nutt-Hockett Basin	Basin-fill	<500 feet (152 meters)	<100 gpm	Sodium Bicarbonate	Salinity: 0 to 1,000 mg/L (TDS)	NA	NA	NA
Mimbres Valley Basin	Basin-fill; Mountains (igneous, volcanic, or sedimentary units)	<500 feet (152 meters)	Basin-fill, <100 gpm	Calcium Magnesium Bicarbonate; Southwestern edge of Sierra County: Sodium Bicarbonate	Basin-fill: Salinity: 0 to 500 mg/L (TDS)	NA	NA	NA
Hueco Basin	Basin-fill	200 to 500 feet (61 to 152 meters)	NA	Sulfate	Salinity: 0 to 3,000 mg/L (TDS)	Water movement from Tularosa Basin	Seepage to Rio Grande withdrawals for municipal, industrial, and military activities	Declining water levels due to withdrawals; Saline water, freshwater only along western edge and northern area of basin
Penasco Basin	Mountains (igneous, volcanic, sedimentary units); San Andres Limestone; Yeso Formation	<500 feet (152 meters)	NA	NA	Limestone: Salinity: 434 mg/L (TDS) (Maximum); Nitrates: 6.2 mg/L (average)	Yeso Formation: precipitation and infiltration	Water movement to springs or movement downdip through formation	NA

APPENDIX C
SUMMARY OF DECLARED AND UNDECLARED UNDERGROUND BASINS

Underground Basin	Aquifer Occurrence	Depth to Water	Well Yields	Dominant Chemical	Water Quality¹	Recharge	Discharge	Problems
Gila-San Francisco Basin	Mountains (igneous, volcanic, or sedimentary units)	Southeastern section: >500 feet (152 meters); majority of basin: <500 feet (152 meters)	<100 gpm	Sodium Bicarbonate; Southwestern corner of basin: Calcium Magnesium Bicarbonate	Salinity: 0 to 500 mg/L (TDS)	NA	NA	NA
Hondo Basin	Limestone; Mountains (igneous, volcanic, or sedimentary units)	<500 feet (152 meters); northwestern part of basin: >500 feet (152 meters)	NA	NA	NA	NA	NA	NA

SOURCE: Anderhom et al. 1995; Brady et al. 1984; Bureau of Land Management 1984; Cox et al. 1962; Davie et al. 1967; Garza and McLean 1971; Hood 1960; Ong 1988; Orr et al. 1992; Reeder et al. 1959; State Engineer's Office 1957; Thompson et al. 1984; West et al. 1965

NOTES:
 Water quality information not available for the Hondo Declared Basin
 NA = information not available

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Plant Species					
Kuenzler hedgehog cactus	<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	FE NM End	- occurs in piñon-juniper/grass mountain habitats	present, known to occur in the Elk/Mayhill area, Otero County	present
Sacramento prickly poppy	<i>Argemone pleiacantha</i> ssp. <i>pinnatisecta</i>	FE	- occurs in riparian and arroyo habitats	present, known to occur in the Sacramento Escarpment	present, distribution narrowly extends outside the Sacramento Escarpment ACEC
Todsen's pennyroyal	<i>Hedeoma todsenii</i>	FE w/CH NM End	- occurs in piñon-juniper grass mountain habitats - critical habitat has been designated in Otero County	present, known to occur in the Sacramento Mountains south of Bent	present
Sacramento Mountains thistle	<i>Cirsium vinaceum</i>	FT	- endemic to the Sacramento Mountains where it grows on travertine deposits of natural springs - occurs in montane coniferous forest and subalpine grassland habitats	present, known to occur in the Sacramento Mountains	unlikely occurrence, habitat range is outside of Decision Area
Goodding's onion	<i>Allium gooddingii</i>	C	- occurs in montane and subalpine coniferous forests	present, known to occur in the Sacramento Mountains	unlikely occurrence, habitat range is outside of Decision Area

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Alamo beardtongue	<i>Penstemon alamosensis</i>	SC BLMS	- occurs in mixed shrub hill and arroyo habitats	present, known to occur in the Sacramento Escarpment	unlikely occurrence, distribution does not extend outside Sacramento Escarpment ACEC and therefore is not in the Decision Area
Duncan's cory cactus	<i>Coryphantha duncanii</i>	SC NM End BLMS	- occurs in creosote hill and mixed shrub mountain habitats	present, known to occur in the Mud Mountains	present
Glass Mountain coral-root	<i>Hexalectris nitida</i>	SC NM End BLMS	- occurs in grass mountain habitats	present, known to occur on private land in the Cornudas Mountains	present
Gypsum scalebroom	<i>Lepidospartum burgessii</i>	SC NM End BLMS	- occurs in salt flat habitats	present, within New Mexico, only occurs in the Guadalupe Ranch, Otero County	unlikely occurrence, distribution does not extend outside the Alkali Lakes ACEC and is therefore not in the Decision Area
Sandhill goosefoot	<i>Chenopodium cycloides</i>	SC	- occurs in grasslands and semi-desert grasslands	unlikely occurrence, not known to occur in Sierra or Otero Counties	unlikely occurrence
Sierra Blanca cliffdaisy	<i>Chaetopappa elegans</i>	SC	- occurs in montane coniferous forest habitats on igneous outcrops - endemic to the Sacramento Mountains	present, known to occur in the Sacramento Mountains	unlikely occurrence, habitat is not present in the Decision Area

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Villard's pincushion cactus	<i>Escobaria villardii</i>	SC NM End BLMS	- occurs in mixed shrub hill habitats. - endemic to the Sacramento Escarpment	present, known to occur only in the Sacramento Escarpment ACEC	unlikely occurrence, distribution does not extend outside the Sacramento Escarpment ACEC and is therefore not in the Decision Area
Wright's marsh thistle	<i>Cirsium wrightii</i>	SC	- occurs in springs and cienegas	present, potential distribution includes the base of the Sacramento Escarpment from Three Rivers to Alamogordo	potential occurrence
Desert night-blooming cereus	<i>Cereus greggii</i> var. <i>greggii</i>	SC NM End BLMS	- occurs in creosote rolling uplands and arroyo riparian habitats	potential occurrence	potential occurrence
Guadalupe rabbitbrush	<i>Chrysothamnus nauseosus</i> var. <i>texensis</i>	SC BLMS	- occurs in grass mountain habitats	present, known to occur in the Brokeoff Mountains and Guadalupe Mountains	present
Pinos Altos flameflower	<i>Talinum humile</i>	SC	- occurs in Chihuahua desert scrub habitats	unlikely occurrence	unlikely occurrence
Fish hook barrel cactus	<i>Ferocactus hamatacanthus</i> var. <i>hamatacanthus</i>	BLMS	- occurs in mixed shrub hill habitats	present, known to occur just west of the Cornudas Mountains	present

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Grama grass cactus	<i>Toumeyia papyracanthus</i>	BLMS	- occurs in grama grasslands and alkali sacaton on gypsum soils	present, known to occur in Guadalupe Ranch, McGregor Range, Lake Holloman south to Tres Hermanas	present
Guadalupe Mountains mescal bean	<i>Sophora gypsophila</i> var. <i>guadalupensis</i>	BLMS	- occurs in grass mountain and arroyo habitats	present, known to occur in the Brokeoff Mountains	present
Sheer's cory cactus	<i>Coryphantha scheeri</i> var. <i>uncinata</i>	NM End	- occurs along the creosote breaks of the Rio Grande	present, known to occur along the breaks of the Rio Grande as far north as Mud Mountain	present
Gray sibara	<i>Sibara grisea</i>	LCFOS Sensitive	- occurs in grass mountain habitats, typically in cliff habitats	present, known to occur in the Sacramento Escarpment and the Brokeoff Mountains	present
Gypsum blazingstar	<i>Mentzelia humilis</i> var. <i>guadalupensis</i>	LCFOS Sensitive	- occurs on gypsum outcrops	present, known to occur near or at Pup Canyon, Otero County	present
Gypsum ringstem	<i>Anulocaulis gypsogenus</i> var. <i>howardii</i>	LCFOS Sensitive	- occurs on gypsum outcrops in mixed shrub mountain habitats	present, known to occur near or at Pup Canyon, Otero County	present
Roetter's hedgehog cactus	<i>Echinocereus x Roetteri</i> var. <i>Roetteri</i>	LCFOS Sensitive	- occurs in Chihuahuan desert scrub and semidesert grassland habitats	present, known to occur as a large hybrid population in the Jarilla Mountains at Orogrande	present

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Mosquito plant	<i>Agastache cana</i>	NM Rare	- occurs in cold adapted evergreen woodland at intermediate elevations	present, known to occur in Sierra and Otero Counties	known to occur in Percha Creek nominated ACEC
Animal Species					
American peregrine falcon	<i>Falco peregrinus anatum</i>	NM End BLM Sensitive	- nests in cliff areas and forages near water as well as a variety of desert and woodland-brushland habitats	present, forages in most habitat types. Potential nesting habitat exists in vicinity of Sacramento Escarpment. Other areas of potential nesting habitat occur on Wind Mountains, Cornudas Mountains, and Alamo Mountain, Guadalupe Rim, Brokeoff Mountains, San Andreas Mountains, Caballo Mountains, and Black Range	present
Black-footed ferret	<i>Mustela nigripes</i>	FE	- occurs in grass flat and grass rolling upland habitats - not believed to have occurred in Sierra and Otero Counties (Hubbard and Schmitt 1983)	unlikely occurrence, considered to be extirpated from New Mexico; potential recovery habitat is considered unlikely due to the small size of the prairie dog towns	unlikely occurrence
Brown pelican	<i>Pelecanus occidentalis</i>	FE	- usually occurs in marine habitats in warm waters and rarely occurs inland	present, occasional transient birds have been documented	Unlikely occurrence in Decision Area

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Gila trout	<i>Oncorhynchus gilae</i>	FE	<ul style="list-style-type: none"> - small, cool, clear mountain streams, along which riparian vegetation provides a fairly complete canopy - deep pools are important for survival of the fish during drought 	present, populations occur in headwater streams of the Gila River and San Francisco River drainages in the Gila National Forest	Unlikely occurrence, populations are restricted to the Gila River Drainage west of the Black Range and are not in the Rio Grande drainage.
Interior least tern	<i>Sterna antillarum</i>	FE	<ul style="list-style-type: none"> - nests on sandbars, reservoir shoreline, and alkaline flats - colonial nester 	present, known to occur on the Gila National Forest, Lake Holloman, and McGregor Range (incidental occurrence - no breeding habitat present)	Potential occurrence, may occur on the playas south of Holloman Air Force Base
Northern aplomado falcon	<i>Falco femoralis septentrionalis</i>	FE NM End	<ul style="list-style-type: none"> - occurs in grass flats, grass rolling uplands, and salt flats habitats - grasslands of Otero Mesa are considered essential habitat for recovery 	potential occurrence, dispersing individuals from Mexico may utilize grasslands in Otero County	potential occurrence
Whooping crane	<i>Grus americana</i>	FE	<ul style="list-style-type: none"> - during the winter, whooping cranes roost on sand bars and forage in agricultural fields and valley pastures 	potential occurrence, during fall and winter, whooping cranes may occur in middle Rio Grande Valley	unlikely occurrence, whooping cranes are unlikely to use habitats in the Decision Area
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	FE w/PCH	<ul style="list-style-type: none"> - occurs in high quality riparian habitat with cottonwoods and willows, and occasionally salt cedar 	potential occurrence, although field surveys have not identified any individuals	potential occurrence

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Bald eagle	<i>Haliaeetus leucocephalus</i>	FT NM Thr	- occurs in riparian, arroyo, grass flat, grass rolling upland, and creosote rolling upland habitats	present, a nest site is present on private land in Sierra County; winter roosting occurs on Lincoln National Forest	present, known to roost and forage in the Decision Area.
Mexican spotted owl	<i>Strix occidentalis lucida</i>	FT	- forages in a variety of woodland-brushland and desert habitats. Nests in dense coniferous forests on Lincoln National Forest	present, known to occur in Lincoln National Forest; primary activity centers are identified on Lincoln National Forest	present, known to forage in areas adjacent to Lincoln National Forest
Arizona black-tailed prairie dog	<i>Cynomys ludovicianus arizonensis</i>	C (BLMS)	- occurs in grass flats and grass rolling uplands habitats	present, known to occur in Otero County; historically occurred in Sierra County	present, known to occur in Otero County
Chiricahua leopard frog	<i>Rana chiricahuensis</i>	C BLMS	- occurs in a variety of permanent aquatic habitats including thermal springs and seeps, stock tanks, wells, intermittent rocky creeks, and mainstream river reaches - occurs at elevations from 3,280 to 8,530 feet	present, known to occur in Gila and San Francisco river drainages as well as the Cuchillo Negro Creek, Palomas Creek, and the Seco Creek in Sierra County; potential occurrence in Percha Creek and Animas Creek	potential occurrence
Mountain plover	<i>Charadrius montanus</i>	PT	- occurs in grass flats and grass rolling uplands habitats	present, known to occur on McGregor Range and on Otero Mesa	present

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Arizona southwestern toad	<i>Bufo microscaphus microscaphus</i>	SC BLMS	- occurs in riverine and lacustrine wetland habitats	present, known to occur in the Gila and Cibola National Forests	potential occurrence, although known distribution range is not within the Decision Area
Baird's sparrow	<i>Ammodramus bairdii</i>	SC BLMS	- occurs in grass and mesquite flats and rolling uplands, salt flats, and arroyo habitats	present	present
Big free-tailed Bat	<i>Nyctinomops macrotis</i>	SC BLMS	- primarily occurs in coniferous and mixed woodland habitats and depends on rocky cliffs for roosting	present, known to occur in the Gila and Lincoln National Forests, White Sands Missile Range, and McGregor Range	present
Black tern	<i>Chlidonias niger</i>	SC BLMS	- breeds and feeds along vegetated marshes with open water	present, known to occur in the White Sands Missile Range, and McGregor Range	potential occurrence
Cave myotis	<i>Myotis velifer</i>	SC BLMS	- primarily occurs in desert and lower grasslands but also in piñon-juniper woodlands	present, known to occur in the Gila and Lincoln National Forests, White Sands Missile Range, and McGregor Range	present
Desert bighorn sheep	<i>Ovis canadensis mexicana</i>	NM End	- occurs in arid, rocky mountains in open areas with piñon-juniper to desert scrub habitats	unlikely occurrence, animals previously reintroduced into Sierra County are no longer present	unlikely occurrence

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Desert pocket gopher	<i>Geomys bursarius arenarius</i>	SC BLMS	- occurs in lowland areas with loamy, sandy soil	present, known to occur in the vicinity of Alamogordo and Tularosa	present
Desert sucker	<i>Catostomus clarki</i>	SC BLMS	- occurs in rapids and flowing streams, except in extreme headwater situations	present, known to occur in the Gila National Forest	unlikely occurrence, may occur outside the Gila National Forest but not within the Decision Area
Ferruginous hawk	<i>Buteo regalis</i>	SC BLMS	- occurs in a wide variety of desert habitats as well as piñon-juniper/grass mountain habitats	present	present
Fringed myotis	<i>Myotis thysanodes</i>	SC BLMS	- occurs in mid elevation grasslands, desert, oak and piñon woodlands, as well as high elevation spruce-fir forests	present, known to occur in Cibola, Gila, and Lincoln National Forests, White Sands Missile Range, and McGregor Range	present
Gray-footed chipmunk	<i>Tamias canipes</i>	SC BLMS	- occurs in grass mountain, piñon juniper/grass mountain, and arroyo habitats	present, known to occur in the Lincoln National Forest, Guadalupe Mountains, and piñon-juniper habitat adjacent to McGregor Range	present
Greater western mastiff bat	<i>Eumops perotis californicus</i>	SC BLMS	- occurs in riparian and foothill habitats - roosts in high, steep cliffs	unlikely occurrence, not known to occur in Sierra or Otero Counties; few records in New Mexico	unlikely occurrence

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Guadalupe southern pocket gopher	<i>Thomomys bottae guadalupensis</i>	SC BLMS	- occurs in areas with loamy soil in a variety of habitats ranging from arid lowlands to mountains	present, known to occur in the Guadalupe Mountains	present
Loggerhead shrike	<i>Lanius ludovicianus</i>	SC BLMS	- occurs in a variety of shrub and grass habitats	present	present
Long-legged myotis	<i>Myotis volans</i>	SC BLMS	- primarily occurs in ponderosa pine and piñon-juniper habitats, as well as grassland habitats	present, known to occur in Cibola, Gila, Lincoln National Forests, White Sands Missile Range, and McGregor Range	present
Long-eared myotis	<i>Myotis evotis</i>	SC BLMS	- occurs in piñon and ponderosa pine habitats	present, known to occur in Gila and Cibola National Forests	present
Longfin dace	<i>Agosia chrysogaster</i>	SC BLMS	- habitat ranges from clear, cool mountain brooks to small intermittent desert streams with a sand or gravel substrate	present, occurs in Gila and San Francisco River drainages	present, known to occur in Percha Creek
Mineral Creek mountain snail	<i>Oreohelix pilsbryi</i>	SC	- occurs in an extremely small area along Mineral Creek	present, known to occur near Chloride on Mineral Creek	present
Neotropic cormorant	<i>Phalacrocorax brasilianus</i>	NM Thr	- generally occurs in larger bodies of water, such as reservoirs - preys on fish - require stands of trees or shrubs in or near water	present, known to nest at the Elephant Butte and Caballo Reservoirs; occasionally occurs near Alamogordo	potential occurrence, may occur as a vagrant species in the Decision Area

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
New Mexican jumping mouse	<i>Zapus hudsonius luteus</i>	SC NM Thr BLMS	- occurs in riparian habitats	present, known to occur in the Sacramento Mountains in the Cloudcroft area	potential occurrence
Northern goshawk	<i>Accipiter gentilis</i>	SC BLMS	- utilizes forest, woodland, and shrubland habitats	present, known to occur in and adjacent to Lincoln and Gila National Forests	present
Occult little brown bat	<i>Myotis lucifugus occultus</i>	SC BLMS	- occurs in ponderosa pine and mixed conifer forest habitats, as well as piñon-juniper habitats	present, known to occur in Cibola, Gila, and Lincoln National Forests	present
Organ Mountains Colorado chipmunk	<i>Eutamias quadrivittatus australis</i>	SC BLMS	- endemic to the Organ Mountains	present	unlikely occurrence
Pale Townsend's big-eared bat	<i>Plecotus townsendii pallescens</i>	SC BLMS	- occurs in grass mountain, piñon-juniper, and arroyo habitats - strongly associated with caves	present, known to occur in Cibola, Gila, and Lincoln National Forests, White Sands Missile Range, and McGregor Range	present
Sacramento Mountains salamander	<i>Aneides hardii</i>	SC	- occurs in higher elevation sites characterized by Douglas-fir, true firs, spruces, and some pines with substantial canopy cover	present, known to occur only in the Sacramento, White, and Capitan Mountains	unlikely occurrence, required habitat is not present in the Decision Area
Small-footed myotis	<i>Myotis ciliolabrum</i>	SC BLMS	- occurs in creosote rolling upland habitats	present	present

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Sonora sucker	<i>Catostomus insignis</i>	SC BLMS	- occurs in a variety of habitats from warm rivers to trout streams	present, known to occur in the Gila River drainages in the Gila National Forest	unlikely occurrence, distribution is restricted to the Gila River
Southwestern otter	<i>Lutra canadensis sonorae</i>	SC	- inhabits permanent riparian habitats	unlikely occurrence, considered to be extirpated from New Mexico	unlikely occurrence
Speckled dace	<i>Rhinichthys osculus (Gila drainage)</i>	SC	- occurs in shallow, rocky, headwater streams with relatively swift flow	present, known to occur in the Gila River drainages in Gila National Forest	unlikely occurrence, distribution is restricted to the Gila River
Spotted bat	<i>Euderma maculatum</i>	SC BLMS	- occurs in grass flats, grass mountain, piñon-juniper/grass mountain, and riparian habitats	present, known to occur in Sierra County	present
Texas horned lizard	<i>Phrynosoma cornutum</i>	SC BLMS	- occurs in a variety of shrub, grass, and salt flat habitats	present	present
Western burrowing owl	<i>Speotyto cunicularia hypugea</i>	SC BLMS	- occurs in grassland habitats - nest in abandoned burrows of prairie dogs, ground squirrels, woodchucks, foxes, and badgers	present	present
White-faced ibis	<i>Plegadis chihi</i>	SC BLMS	- occurs in grass flat, salt flat, and riparian habitats - nests in shoreline and marsh habitats bordered by open water	present, known to occur in the Gila and Lincoln National Forests, White Sands Missile Range, and McGregor Range	potential occurrence

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
White Sands pupfish	<i>Cyprinodon tularosa</i>	SC	- inhabits fine mud silt and sand gravel bottoms of clear, shallow, highly alkaline pools and streams of the Tularosa Valley	present, known to occur on the White Sands Missile Range	unlikely occurrence, known only to occur within the White Sands Missile Range
White Sands woodrat	<i>Neotoma micropus leucophaea</i>	SC	- inhabits lowland areas with sandy soils	present, known to occur in the White Sands Missile Range and is likely to occur elsewhere within the Tularosa Basin	likely occurrence
Yuma myotis	<i>Myotis yumanensis</i>	SC BLMS	- occurs in piñon-juniper/grass mountain habitat	present, known to occur in Cibola and Gila National Forests, and McGregor Range	present
Cornudas Mountains land snail	<i>Ashmunella amblya cornudasensis</i>	LCFOS Sensitive	- occurs in talus slopes in mountain habitats	present, only known to occur in the Cornudas Mountains	present, distribution extends beyond the Cornudas Mountains ACEC boundaries and therefore IS within the Decision Area

APPENDIX D-I
SPECIAL STATUS SPECIES POTENTIALLY PRESENT IN THE PLANNING AND DECISION AREAS

Common Name	Scientific Name	Status	Habitat Characterization and General Distribution Information	Potential Presence in Planning Area (Sierra and Otero Counties)	Potential Presence in Decision Area
Yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	LCFOS Sensitive	- breeds in riparian woodlands and similar habitats at lower (2,800 to 5,500 feet) and middle (5,000 to 7,500 feet) elevations	present, known to occur in the Lincoln National Forest, White Sands Missile Range, McGregor Range, and Rio Grande Valley	present

SOURCES:

M. Howard, personal communication, 1999
 New Mexico Department of Game and Fish 1999a

NOTES:

Status=FE-Federally endangered FT=Federally threatened PE=Proposed endangered PT=Proposed threatened C=Candidate SC=Former Candidate Category 2 Species BLMS=BLM sensitive LCFOS=Las Cruces Field Office Sensitive NM End=New Mexico endangered NM Thr=New Mexico threatened CH=Critical habitat designated July 1999 PCH=Proposed critical habitat ACEC = Area of Critical Environmental Concern

APPENDIX D-II SPECIAL STATUS SPECIES ACCOUNTS

FEDERALLY LISTED PLANT SPECIES

Kuenzler Hedgehog Cactus (*Echinocereus fendleri* var. *kuenzleri*) - Federally Endangered, New Mexico Endangered

The Kuenzler hedgehog cactus grows between rocks on gently sloping limestone outcrops in piñon-juniper woodlands from 5,800 to 6,600 feet elevation. This cactus is known to occur in northeast Otero and adjacent Chaves and Lincoln Counties. Within Otero County, it is known to occur on the Mescalero Apache Indian Reservation, in the Elk/Mahill area, and in the areas east of the Guadalupe Mountains. No known populations occur in Sierra County.

Sacramento Prickly Poppy (*Argemone pleiacantha* ssp. *pinnatisecta*) - Federally Endangered, New Mexico Endangered

The Sacramento prickly poppy occurs in riparian and arroyo habitats and is endemic to 10 canyons on the Sacramento Escarpment from High Rolls to Escondido Canyon in Otero County. On public land, its habitat extends approximately 1 mile onto the Escarpment pediment from the mouth of Alamo and San Andrea Canyons. The Bureau of Land Management (BLM) population of this species varies from 1 to approximately 20 plants. They are apparently the result of seeds washing down canyon from the population on the Lincoln National Forest at higher elevations. Xeric habitat conditions at the known elevations on BLM land appear to limit the species to arroyos where sufficient moisture is available to support them. Plants appear to persist only as long as environmental conditions remain moist, and plants are not removed by channel scouring. On public land, this plant occurs only within the Sacramento Escarpment Area of Critical Environmental Concern (ACEC). The main populations occur in the higher elevations on the Lincoln National Forest. Some plants also may occur on private land within this area. No populations of this species are known to occur in Sierra County.

Todsen's Pennyroyal (*Hedeoma todsenii*) - Federally Endangered, New Mexico Endangered

The Todsen's pennyroyal occurs on north and east facing steep slopes (from 6,600 to 7,400 feet elevation) in gravelly gypseous limestone soil in piñon-juniper woodland and sometimes ponderosa pine vegetation. It produces red-orange flowers that appear from July to September. Reproduction is mainly by rhizomatous cloning. This plant is known to occur only in the San Andrea Mountains on the White Sands Missile Range in Sierra County and on the other side of the Tularosa Basin in the

Sacramento Mountains in Otero County. A relatively large population occurs on public land on the western edge of the Sacramento Mountains, and a small population occurs on the adjacent Lincoln National Forest. Critical habitat has been designated on public land in Otero County.

PLANT SPECIES OF CONCERN

Duncan's Cory Cactus (*Coryphantha duncanii*) - Species of Concern, New Mexico Endangered, BLM Sensitive

This cactus occurs on alternating dolomite and chert of the Aleman formation and limestone outcrops and soils among Chihuahuan Desert shrub vegetation at 3,000 to 5,000 feet elevation. Flower petaloid parts are pink and lance-shaped, and the flowers are red. Flowering occurs from May to July. Within New Mexico, this species is known to occur only in the Mud Mountains northwest of Truth or Consequences in Sierra County.

Glass Mountain Coral-root (*Hexalectris nitida*) - Species of Concern, New Mexico Endangered, BLM Sensitive

The Glass Mountain coral-root is a saprophytic (i.e., obtains its nutrients from dead organic matter) plant that occurs under oak trees in grassy, mountain habitats. Within the Planning Area, this plant is known only to occur in an area of private land in the Cornudas Mountains in Otero County. It also may occur elsewhere in New Mexico.

Wright's Marsh Thistle (*Cirsium wrightii*) - Species of Concern

The Wright's marsh thistles occurs in spring and cienega habitats. This thistle may occur in Otero County and its potential distribution includes the base of the Sacramento Escarpment from Three Rivers to Alamogordo (Howard 1999).

Desert Night-blooming Cereus (*Cereus greggii* var. *greggii*) - Species of Concern, New Mexico Endangered, BLM Sensitive

The night-blooming cereus grows in washes or flats, often under bushes or shrubs, at approximately 3,000 to 5,000 feet elevation. The flowers are white, opening at nights, about 8 inches long, and appear in June. The plants are popular with cactus collectors and populations have been decimated by collectors. This cactus may occur in Sierra or Otero County, although no populations are known to be present.

Guadalupe Rabbitbrush (*Chrysothamnus nauseosus* var. *texensis*) - Species of Concern, BLM Sensitive

The Guadalupe rabbitbrush occurs in limestone cliffs and streambeds at elevations of 4,900 to 7,000 feet. This low, spreading shrub has yellow flowers and is unique in having a long stigma and short pappus. This plant is known to occur in the Brokeoff and Guadalupe Mountains in Otero County. Other populations occur in the Guadalupe Mountains in Eddy County, New Mexico, and Culberson County, Texas.

BLM SENSITIVE SPECIES

Fish Hook Barrel Cactus (*Ferocactus hamatacanthus* var. *hamatacanthus*) - BLM Sensitive

The fish hook cactus occurs in mixed shrub hill habitats. This cactus was reported to occur just west of the Cornudas Mountains in Otero County.

Grama Grass Cactus (*Toumeya papyracanthus*) - BLM Sensitive

The grama grass cactus occurs in open flats in grasslands and piñon-juniper woodlands on sandy-gravelly and occasionally gypseous soils at 5,000 to 7,300 feet elevation. At one time, this species may have had a considerably larger range and may have been more abundant. Increased grazing has decreased the numbers of cactus. This cactus is located primarily in northern, central, and southern New Mexico as well as central Arizona. It is known to occur in Otero County on the Guadalupe Ranch, McGregor Range, and in the Tularosa Basin from Lake Holloman to Tres Hermanas. The range has been discovered to be larger than thought originally; however, population numbers within this range are likely reduced due to various land use practices.

Guadalupe Mountains Mescal Bean (*Sophora gypsophila* var. *guadalupensis*) - BLM Sensitive

The Guadalupe Mountains mescal bean occurs in grass mountain and arroyo habitats. This plant is a rare endemic to the Guadalupe-Brokeoff Mountain range and is known to occur in the Brokeoff Mountains in Otero County.

NEW MEXICO ENDANGERED SPECIES

Sheer's Cory Cactus (*Coryphantha scheeri* var. *uncinata*) - New Mexico Endangered

The Sheer's cory cactus occurs along the Rio Grande in creosote breaks as far north as the Mud Mountains. Its habitat is disappearing due to urbanization along the Rio Grande. This cactus occurs in Dona Ana and Sierra Counties in New Mexico as well as in Texas and New Mexico (Sivinski and Lightfoot 1995).

BLM LAS CRUCES FIELD OFFICE (LCFO) SENSITIVE SPECIES

Gray Sibara (*Sibara grisea*) - BLM LCFO Sensitive

The gray sibara occurs in grass mountain habitats, typically in limestone cliffs and crevices. This plant is known to occur in Chaves, Eddy, and Otero Counties in New Mexico and in Texas. In Otero County, it is known to occur in the Sacramento Escarpment and the Brokeoff Mountains (Sivinski and Lightfoot 1995).

Gypsum Blazingstar (*Mentzelia humilis* var. *guadalupensis*) - BLM LCFO Sensitive

The gypsum blazingstar occurs on gypsum outcrops on sloping hillsides. This plant is known to occur on the west face of the Guadalupe Mountains near or at the mouth of Pup Canyon in Otero County (Howard 1999).

Gypsum Ringstem (*Anulocaulis leisolenus* var. *howardii*) - BLM LCFO Sensitive

The gypsum ringstem occurs on gypsum outcrops in mixed shrub mountain habitats. This plant is known to occur on the west face of the Guadalupe Mountains near or at the mouth of Pup Canyon in Otero County (Howard 1999).

Roetter's Hedgehog Cactus (*Echinocereus* x *Roetteri* var. *Roetteri*) - BLM LCFO Sensitive

The Roetter's hedgehog cactus occurs in Chihuahuan desert scrub and semidesert grassland habitats. Its attractive flowers and uniqueness make it susceptible to plant collectors. This hybrid cactus occurs as a large population in the Jarilla Mountains at Orogrande in Otero County (Howard 1999).

NEW MEXICO RARE SPECIES

Mosquito Plant (*Agastache cana*) - New Mexico Rare

The mosquito plant occurs in cold adapted evergreen woodland at intermediate elevations. This habitat is widespread throughout New Mexico, and usually occurs at elevations between 5,500 feet to 7,500 feet. It is known to occur in Dona Ana, Grant, Lincoln, Luna, Otero, and Sierra Counties.

FEDERALLY LISTED, PROPOSED, AND CANDIDATE ANIMAL SPECIES

Interior Least Tern (*Sterna antillarum*) - Federally Endangered

The interior least tern nests in colonies on sandy beaches on shorelines of streams, rivers, and alkaline flats. It is a vagrant along the Rio Grande corridor and known to occur on the Gila National Forest and at Lake Holloman and incidental occurrences have been reported on McGregor Range (New Mexico Department of Game and Fish [NMDGF] 1999a).

Northern Aplomado Falcon (*Falco femoralis septentrionalis*) - Federally Endangered, New Mexico Endangered

Habitat known to be utilized by aplomado falcons consists of desert grasslands with scattered mesquite and yucca, riparian woodlands in open grasslands, and among yucca-covered sand ridges in coastal prairies. Aplomado falcons are not known to build their own nests, and in the southwestern United States, they use previously constructed nests located in the saddle of branched yuccas, in mesquites, or on the tops of crucifixion bushes (BLM 1996).

Aplomado falcons were believed to have been extirpated in the United States since the late 1950s. Recently, a population of aplomado falcons was confirmed in the extensive grassland communities of northern Mexico. In addition, three reports of aplomado falcons were verified on or adjacent to the White Sands Missile Range during 1991 and 1992. A third observation was made on U.S. Highway 380 between Carrizo and San Antonio, New Mexico in 1992. In 1995, the only known active nest was documented in Cameron County, Texas. This is the first documented nesting in the United States since 1952 (BLM 1996). Seven sightings were made within the Planning Area in 1999 (Howard, personal communication, 1999). No critical habitat has been identified within the United States. Areas of potential aplomado falcon habitat have been identified in Sierra and Otero Counties in grassland areas.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) - Federally Endangered

The southwestern willow flycatcher is a species that has specialized in the use of cottonwood/willow riparian habitats for nesting. The species migrates into the southwest United States from Mexico and Central America by mid-May. Breeding, nesting, and rearing are completed by early July. Breeding range, as depicted by Hubbard (1987), follows along the eastern boundary of the Rio Grande Valley from El Paso northward and deviates easterly in Torrance County to the east side of the Sangre de Cristo Mountains. However, specimens of *E.t. extimus* have been taken during migration in Roosevelt County in 1975 and 1976. While this leaves breeding occurrence of the species east of the Rio Grande in question, there have been no verified accounts of breeding reported east of Hubbard's 1987 breeding habitat boundary to date. This suggests that the occurrence of *E.t. extimus* in the Planning Area is unlikely (BLM 1997).

The species is threatened by modification and loss of riparian habitats, and by nest parasitism by brown headed cowbirds. There is no critical habitat in Sierra and Otero Counties. Potential habitat, of low quality, occurs in the Planning Area at Three Rivers Petroglyph Site ACEC, Palomas Creek, Percha Creek, Laborcita Canyon, and Tierra Blanca Creek (U.S. Fish and Wildlife Service [USFWS] 1997).

Bald Eagle (*Haliaeetus leucocephalus*) - Federally Threatened, New Mexico Threatened

The bald eagle occurs in New Mexico mainly as a migrant and a winter resident. It primarily occurs in riparian areas adjacent to rivers, reservoirs, and ponds, and roosts in large trees that may be close to foraging areas. Other foraging habitats include grass flats, rolling uplands, and creosote rolling upland habitats. Rabbits, fish, and waterfowl are the primary prey items. One bald eagle nest is known to occur on private land in Sierra County.

Mexican Spotted Owl (*Strix occidentalis lucida*) - Federally Threatened

The Mexican spotted owl occurs in varied habitat consisting primarily of mature montane forest. Uneven-aged stands with high canopy closure, high tree density, multilayered canopy, and a terrain with slopes greater than 15 degrees appear to be key habitat characteristics in forested habitats. Nest sites have been identified on the Lincoln National Forest, and individual birds have been observed foraging east of Lincoln National Forest. Primary activity centers (PACs) have been identified on the Lincoln National Forest. Nesting also occurs in the Gila National Forest.

Mountain Plover (*Charadrius montanus*) - Proposed Threatened

The mountain plover is associated with shortgrass and shrub-steppe landscapes throughout its breeding and wintering range. Breeding occurs in the Rocky Mountain states from Canada to Mexico with most breeding birds occurring in Montana and Colorado. Most wintering birds occur in California and some occur in Arizona, Texas, and Mexico (USFWS 1999). Conversion of grassland habitats, agricultural practices, grazing, and the decline of native herbivores have likely resulted in the decline of this species. Mountain plovers are known to occur in Otero County on McGregor Range and Otero Mesa.

Arizona Black-tailed Prairie Dog (*Cynomys ludovicianus arizonensis*) - Federal Candidate, BLM Sensitive

The Arizona black-tailed prairie dog occurs on flat, dry, open grasslands of mesa tops or valley bottoms within the broad limits of the Upper Sonoran Zone. It is known to occur in Otero County on McGregor Range and Otero Mesa (NMDGF 1999a). This species historically occurred in Sierra County.

Chiricahua Leopard Frog (*Rana chiricahuensis*) - Federal Candidate, BLM Sensitive

This frog occurs in a variety of permanent aquatic habitats including thermal springs and seeps, stock tanks, wells, intermittent rocky creeks, and mainstream river reaches. It occurs at elevations from 3,280 to 8,530 feet (NMDGF 1999a). The Chiricahua leopard frog is known to occur in the Gila and San Francisco River drainages, as well as the Cuchillo Negro Creek, Palomas Creek, and the Seco Creek in Sierra County. It has the potential to occur in Percha Creek and Animas Creek (Howard 1999). Population declines may be the result of predation and competition from bullfrogs or predation by introduced fishes (NMDGF 1999a).

ANIMAL SPECIES OF CONCERN

American Peregrine Falcon (*Falco peregrinus anatum*) - New Mexico Endangered, BLM Sensitive

This species nests on steep rocky cliffs, often near water, and often near piñon-juniper habitats. It often forages near water, but also is documented as foraging in most habitat types throughout the Sierra and Otero Counties. Potential nesting habitat exists within the vicinity of the Sacramento Escarpment due to the presence of numerous large cliff faces. Most of these cliffs occur within the Lincoln National Forest, immediately adjacent to the existing Sacramento ACEC. In addition, a small amount of potential nesting habitat may occur on Wind Mountain, Cornudas Mountain, Alamo Mountain,

Guadalupe Rim, Brokeoff Mountain, San Andrea Mountain, Caballo Mountains, and the Black Range (Howard 1999).

Arizona Southwestern Toad (*Bufo microscaphus microscaphus*) - Species of Concern, BLM Sensitive

The Arizona southwestern toad occurs in riverine and lacustrine wetland habitats. Its range includes Arizona, New Mexico, Utah, and Mexico. It is known to occur in the Gila and Cibola National Forests in Sierra County (NMDGF 1999a).

Baird's Sparrow (*Ammodramus bairdii*) - Species of Concern, New Mexico Threatened, BLM Sensitive

The Baird's sparrow occurs in grass and mesquite flats and rolling uplands, salt flats, and arroyo habitats. Its winter range includes New Mexico, Arizona, and Oklahoma, and areas south of the United States. Within Sierra and Otero Counties, it is generally considered to be a migratory species. It is known to occur in the Gila and Lincoln National Forests, White Sands Missile Range, and McGregor Range (NMDGF 1999a).

Big Free-tailed Bat (*Nyctinomops macrotis*) - Species of Concern, BLM Sensitive

This bat appears to prefer coniferous and mixed woodland habitats, but have been taken in a variety of habitats. It is dependent on rocky cliffs with cracks and fissures for roosting. It is known to occur in the Gila and Lincoln National Forests, White Sands Missile Range, and McGregor Range (NMDGF 1999a).

Black Tern (*Chlidonias niger*) - Species of Concern, BLM Sensitive

The black tern forages and breeds in vegetated marshes with areas of open water. It is considered to be an uncommon summer migrant species in Sierra and Otero Counties and has been observed in the White Sands Missile Range and McGregor Range (NMDGF 1999a).

Cave Myotis (*Myotis velifer*) - Species of Concern, BLM Sensitive

The cave myotis primarily occurs in desert and lower grasslands, but also in piñon-juniper woodlands. It inhabits mine shafts, tunnels, caves, and bridges (NMDGF 1999a). Its range includes New Mexico,

Arizona, Texas, Oklahoma, and Utah. Within Sierra and Otero Counties, it is known to occur in the Gila and Lincoln National Forests, White Sands Missile Range, and McGregor Range (NMDGF 1999a).

Desert Pocket Gopher (*Geomys bursarius arenarius*) - Species of Concern, BLM Sensitive

The desert pocket gopher inhabits lowland areas with loamy, sandy soils. It tends to avoid areas with sandy or rocky soils (Bogan 1999). It is known to occur in Otero County in the vicinity of Alamogordo and Tularosa, but is not known to occur in Sierra County (Bogan 1999).

Ferruginous Hawk (*Buteo regalis*) - Species of Concern, BLM Sensitive

The ferruginous hawk utilizes open grasslands and prairies, especially for nesting. It occurs in New Mexico both as a winter migrant and a nesting resident. It is present in Sierra and Otero Counties as a migrant (BLM 1997).

Fringed Myotis (*Myotis thysanodes*) - Species of Concern, BLM Sensitive

This bat primarily occurs in mid-elevation grasslands, desert, oak and piñon woodlands, but also in high-elevation spruce-fir forests. The range of this species includes New Mexico, Arizona, Colorado, and Texas. It occurs in both Sierra and Otero Counties and specifically is known to occur in Cibola, Gila, and Lincoln National Forests, White Sands Missile Range, and McGregor Range (NMDGF 1999a).

Gray-footed Chipmunk (*Tamias canipes*) - Species of Concern, BLM Sensitive

The gray-footed chipmunk primarily inhabits forest habitats, but also utilizes piñon-juniper and arroyo habitats. The range of this species includes New Mexico and Texas. Within Otero County, this species is known to occur in the Lincoln National Forest and the Guadalupe Mountains, as well as in piñon-juniper habitats adjacent to McGregor Range (NMDGF 1999a).

Guadalupe Southern Pocket Gopher (*Thomomys bottae guadalupensis*) - Species of Concern, BLM Sensitive

The Guadalupe southern pocket gopher occurs in areas with loamy soil in a variety of habitats ranging from arid lowland to mountains. It tends to avoid areas with rocky soils (Bogan 1999). It is known to

occur in the Guadalupe Mountains in Eddy County, New Mexico, and also may occur in the Guadalupe Mountains in Otero County (Bogan 1999).

Loggerhead Shrike (*Lanius ludovicianus*) - Species of Concern, BLM Sensitive

The loggerhead shrike occurs in a variety of shrub/grassland, open woodland, and chaparral habitats. It is a resident species throughout New Mexico and is rare to fairly common at lower and elevations and locally common at middle elevations. This species is known to be present in both Sierra and Otero Counties.

Long-legged Myotis (*Myotis volans*) - Species of Concern, BLM Sensitive

This bat primarily occurs in ponderosa pine and piñon-juniper habitats, and also occurs in grassland habitats. It uses large ponderosa pine snags, deciduous tree snags, rock crevices, mine shafts, and abandoned buildings for roosting. This migrant species is present in New Mexico from May through September. It is known to occur in Cibola, Gila, and Lincoln National Forests, White Sands Missile Range, and McGregor Range (NMDGF 1999a).

Long-eared Myotis (*Myotis evotis*) - Species of Concern, BLM Sensitive

This bat occurs in piñon-juniper and ponderosa pine habitats. The range of this species includes New Mexico, Arizona, and Utah. Within Sierra County, it is known to occur in the Cibola and Gila National Forests, but has not been identified in Otero County (NMDGF 1999a).

Longfin Dace (*Agosia chrysogaster*) - Species of Concern, BLM Sensitive

The longfin dace occurs in a variety of aquatic habitats ranging from clear, cool mountain brooks to small intermittent desert streams with a sand or gravel substrate (NMDGF 1999a). The range of this species includes New Mexico, Arizona, and Mexico. Within New Mexico, it is present in Sierra County in the Gila River drainages, and San Francisco River. It was introduced into the Rio Grande Basin downstream of the Elephant Butte Reservoir in the 1950s and is present in Percha Creek (NMDGF 1999a).

Mineral Creek Mountain Snail (*Oreohelix pilsbryi*) - Species of Concern

The Mineral Creek mountain snail inhabits an extremely small area 327 by 327 feet (100 by 100 meters) along Mineral Creek in the vicinity of the Oliver's Mine, which is approximately 5 miles north of Chloride, Sierra County (Metcalf and Smartt 1988).

Neotropic Cormorant (*Phalacrocorax brasilianus*) - New Mexico Threatened

The neotropic cormorant generally occurs in larger bodies of water, such as reservoirs. For nesting, they require stands of trees or shrubs near or in water and free from human disturbance. This bird breeds and is variable a resident in the Rio Grande Valley at the Elephant Butte and Caballo Reservoirs, and it is considered to be a vagrant in the Alamogordo area (NMDGF 1999a).

New Mexican Jumping Mouse (*Zapus hudsonius luteus*) - Species of Concern, New Mexico Threatened, BLM Sensitive

The New Mexican jumping mouse inhabits riparian areas bordering permanent streams, ditches, and wet meadows, with dry higher ground near waterways to provide for nesting and hibernation (NMDGF 1999a). The vegetation is tall, dense, and dominated by grasses and forbs. These nocturnal mammals hibernate for much of the year and are active primarily from May through September. Jumping mouse populations have declined because of wetland destruction, overgrazing, urban encroachment, and periodic severe flooding (NMDGF 1999a). This species is known to occur in the Cloudcroft area of the Sacramento Mountains in Otero County. Also it is known to occur in the Pedro Armendaris Land Grant north of Sierra County, although it has not been identified in Sierra County.

Northern Goshawk (*Accipiter gentilis*) - Species of Concern, BLM Sensitive

The northern goshawk utilizes primarily moderate to high canopied mature coniferous forests with sparse underbrush. Nest sites are selected in forest stands with a high density of large trees and canopy closure. The northern goshawk is a resident species throughout the Rocky Mountain states. It is known to occur within and adjacent to the Lincoln and Gila National Forests.

Occult Little Brown Bat (*Myotis lucifugus occultus*) - Species of Concern, BLM Sensitive

This bat occurs in ponderosa pine and mixed conifer forest habitats, as well as piñon-juniper habitats, with permanent water sources, such as streams, rivers, and lakes, where it feeds on flying insects. It is known to occur in the Cibola, Gila, and Lincoln National Forests.

Pale Townsend's Big-eared Bat (*Plecotus townsendii pallescens*) - Species of Concern, BLM Sensitive

This bat occurs in grass mountain, piñon-juniper, and arroyo habitats. It is strongly associated with caves and abandoned mine tunnels that are used by large congregations of bats as day and winter hibernation roosts, as well as for maternity colonies.

Small-footed Myotis (*Myotis ciliolabrum*) - Species of Concern, BLM Sensitive

This bat occurs in creosote rolling upland habitats. It is known to occur in Sierra and Otero Counties.

Spotted Bat (*Euderma maculatum*) - Species of Concern, BLM Sensitive

The spotted bat occurs in a variety of habitats, including grass flats, desert shrub, grass mountain, piñon-juniper, and riparian habitats. It is known to occur in Sierra County.

Texas Horned Lizard (*Phrynosoma cornutum*) - Species of Concern, BLM Sensitive

The Texas horned lizard inhabits arid and semiarid open habitats with sparse plant growth. The substrate may consist of sand, loam, hardpan, or rock, but usually with some loose soil for burying. This species occurs in Sierra and Otero Counties.

Western Burrowing Owl (*Speotyto cunicularia hypugea*) - Species of Concern, BLM Sensitive

The western burrowing owl inhabits level, open, and dry areas that are typical of low-stature grassland or desert, and that contain available burrows. They typically nest in abandoned burrows of prairie dogs, as well as ground squirrels, woodchucks, foxes, and badgers. This species is present in Sierra and Otero Counties.

White-faced Ibis (*Plegadis chihi*) - Species of Concern, BLM Sensitive

The white-faced ibis inhabits grass flats, salt flats, and riparian habitats. It nests in shoreline and marsh habitats bordered by open water. The summer breeding range of the white-faced ibis includes New Mexico, Arizona, Colorado, Oklahoma, and Utah. Within Sierra and Otero Counties, it is known to

occur in the Gila and Lincoln National Forests, White Sands National Monument, and McGregor Range (NMDGF 1999a).

White Sands Woodrat (*Neotoma micropus leucophaea*) - Species of Concern, BLM Sensitive

The White Sands woodrat inhabits lowland areas with sandy soils and burrows under large thorny shrubs (Bogan 1999). It is known to occur in the Tularosa Basin within the White Sands National Monument and the Holloman Air Force Base and is likely to occur elsewhere within the Tularosa Basin. The White Sands woodrat is potentially the same species as the southern plains woodrat (*Neotoma micropus canescens*), which occurs more commonly in eastern New Mexico, although this has not been documented (Bogan 1999).

Yuma Myotis (*Myotis yumanensis*) - Species of Concern, BLM Sensitive

This bat occurs in piñon-juniper habitats. It is known to occur in Cibola and Gila National Forests and McGregor Range.

BLM LCFO SENSITIVE SPECIES

Cornudas Mountains Land Snail (*Ashmunella amblya cornudasensis*) - BLM LCFO Sensitive

The Cornudas Mountains land snail occurs in mixed shrub mountain habitats on the Cornudas Mountains, to which it is endemic. Its distribution range extends outside the Cornudas Mountains ACEC boundaries.

Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) - BLM LCFO Sensitive

The yellow-billed cuckoo breeds in riparian woodlands and similar habitats at lower (2,800 to 5,500 feet) to middle (5,000 to 7,500 feet) elevations. The summer breeding range includes New Mexico, Arizona, Colorado, and Utah. Within Sierra and Otero Counties, it is known to occur in the Lincoln National Forest, White Sands Missile Range, McGregor Range, and Rio Grande Valley (NMDGF 1999a).

APPENDIX D-III
SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM'S DECISION AREA AND ASSOCIATED HABITATS

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Plant Species										
Kuenzler hedgehog cactus	<i>Echinocereus fendleri</i> var. <i>Kuenzleri</i>	FE NM Thr				X				
Sacramento prickly poppy	<i>Argemone pleiakantha</i> ssp. <i>pinnatisecta</i>	FE, NM Thr					X		X	
Todsen's pennyroyal	<i>Hedeoma todsenii</i>	FE w/CH NM Thr				X				
Duncan's cory cactus (Duncan's pincushion cactus)	<i>Coryphantha duncanii</i>	SC NM End		X	X				X	
Glass Mountain coral-root	<i>Hexalectris nitida</i>	SC NM End BLMS				X				

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General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Wright's marsh thistle	<i>Cirsium wrightii</i>	SC							X	
Desert night-blooming cereus	<i>Cereus greggii</i> var. <i>greggii</i>	SC NM End BLMS		X			X			
Guadalupe rabbitbrush	<i>Chrysothamnus nauseosus</i> var. <i>texensis</i>	SC BLMS	X				X			
Fish hook barrel cactus	<i>Ferocactus hamatacanthus</i> var. <i>hamatacanthus</i>	BLMS	X	X	X					
Gramma grass cactus	<i>Toumeyia papyracanthus</i>	BLMS	X							
Guadalupe Mountains mescal bean	<i>Sophora gypsophila</i> var. <i>guadalupensis</i>	BLMS	X			X	X			

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General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Sheer's cory cactus	<i>Coryphantha scheeri</i> var. <i>uncinata</i>	NM End		X						
Gray sibara	<i>Sibara grisea</i>	LCFOS	X							
Gypsum blazingstar	<i>Mentzelia humilis</i> var. <i>guadalupensis</i>	LCFOS			X					
Gypsum ringstem	<i>Anulocaulis gypsogenus</i> var. <i>howardii</i>	LCFOS			X					
Roetter's hedgehog cactus	<i>Echinocereus X Roetteri</i> var. <i>Roetteri</i>	LCFOS	X	X						
Mosquito plant	<i>Agastache cana</i>	NM Rare				X				
Animal Species										
American peregrine falcon	<i>Falco peregrinus anatum</i>	FE NM Thr	X	X	X	X	X		X	

APPENDIX D-III
SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM'S DECISION AREA AND ASSOCIATED HABITATS

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Interior least tern	<i>Sterna antillarum</i>	FE							X	
Northern aplomado falcon	<i>Falco femoralis septentrionalis</i>	FE Nm End	X	X						
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	FE w/PCH							X	
Bald eagle	<i>Haliaeetus leucocephalus</i>	FT NM Thr	X	X			X		X	
Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	FT (S/A)	X	X	X	X	X		X	
Mexican spotted owl	<i>Strix occidentalis lucida</i>	FT	X			X	X		X	
Mountain plover	<i>Charadrius montanus</i>	PT	X							

**APPENDIX D-III
SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM'S DECISION AREA AND ASSOCIATED HABITATS**

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Arizona black-tailed prairie dog	<i>Cynomys ludovicianus arizonensis</i>	C BLMS	X							
Chiricahua leopard frog	<i>Rana chiricahuensis</i>	C BLMS							X	
Arizona southwestern toad	<i>Bufo microscaphus microscaphus</i>	SC BLMS							X	
Baird's sparrow	<i>Ammodramus bairdii</i>	SC NM Thr BLMS	X	X			X		X	
Big free-tailed Bat	<i>Nyctinomops macrotis</i>	SC BLMS		X		X			X	
Black tern	<i>Chlidonias niger</i>	SC BLMS		X						
Cave myotis	<i>Myotis velifer</i>	SC BLMS	X	X		X			X	

APPENDIX D-III
SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM'S DECISION AREA AND ASSOCIATED HABITATS

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Desert pocket gopher	<i>Geomys bursarius arenarius</i>	SC BLMS	X	X						
Ferruginous hawk	<i>Buteo regalis</i>	SC BLMS	X	X	X	X	X		X	
Fringed myotis	<i>Myotis thysanodes</i>	SC BLMS	X	X		X			X	
Gray-banded kingsnake	<i>Lampropeltis alterna</i>	NM End		X	X	X	X			Rocky habitats east of Tularosa Basin
Gray-footed chipmunk	<i>Tamias canipes</i>	SC BLMS				X	X			
Guadalupe southern pocket gopher	<i>Thomomys umbrinus guadalupensis</i>	SC BLMS	X	X		X				
Loggerhead shrike	<i>Lanius ludovicianus</i>	SC BLMS	X	X	X	X	X	X	X	
Long-legged myotis	<i>Myotis volans</i>	SC BLMS	X			X			X	

APPENDIX D-III
SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM'S DECISION AREA AND ASSOCIATED HABITATS

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Long-eared myotis	<i>Myotis evotis</i>	SC BLMS				X			X	
Longfin dace	<i>Agosia chrysogaster</i>	SC BLMS							X	
Mineral Creek mountainsnail	<i>Oreohelix pilsbryi</i>	SC							X	
Mottled rock rattlesnake	<i>Crotalus lepidus lepidus</i>	NM Thr		X	X	X	X			Rocky habitats east of Tularosa Basin
Neotropic cormorant	<i>Phalacrocorax brasilianus</i>	NM Thr				X				
New Mexican jumping mouse	<i>Zapus hudsonius luteus</i>	SC NM Thr BLMS							X	
Northern goshawk	<i>Accipiter gentilis</i>	SC BLMS				X			X	
Occult little brown bat	<i>Myotis lucifugus occultus</i>	SC BLMS				X			X	

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SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM'S DECISION AREA AND ASSOCIATED HABITATS

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Pale Townsend's big-eared bat	<i>Plecotus townsendii pallescens</i>	SC BLMS	X			X	X		X	
Small-footed myotis	<i>Myotis ciliolabrum</i>	SC BLMS	X	X	X	X	X		X	
Spotted bat	<i>Euderma maculatum</i>	SC BLMS	X	X		X			X	
Texas horned lizard	<i>Phrynosoma macrotum</i>	SC BLMS	X	X			X		X	
Western burrowing owl	<i>Speotyto cunicularia hypugea</i>	SC BLMS	X							
White-faced ibis	<i>Plegadis chihi</i>	SC BLMS	X						X	
White Sands woodrat	<i>Neotoma micropus leucophaea</i>	SC BLMS	X	X						
Yuma myotis	<i>Myotis yumanensis</i>	SC BLMS				X			X	

APPENDIX D-III

SPECIAL STATUS SPECIES LIKELY TO OCCUR IN BLM's DECISION AREA AND ASSOCIATED HABITATS

General Information			Habitat Type							
Common Name	Scientific Name	Status	Grasslands	Desert Scrub	Montane Scrub	Woodland/ Forest	Arroyo	Malpais	Riparian/ Other Wetlands	Other (Cropland)
Cornudas Mountains Land snail	<i>Ashmunella amblya cornudasensis</i>	LCFOS			X					
Yellow-billed cuckoo	<i>Coccyzua americanus occidentalis</i>	LCFOS							X	

SOURCES:

M. Howard, Las Cruces BLM Field Office, 1999
 New Mexico Department of Game and Fish, BISON-M Database

NOTES:

Status: FE = Federally Endangered, FT = Federally Threatened, C = Federal Candidate, PE = Proposed Endangered, PT = Federally Proposed Threatened, CH = Critical Habitat designated, SC = Federal Species of Concern, NM End = New Mexico Endangered, NM Thr = New Mexico Threatened, BLMS = BLM Sensitive, LCFOS = Las Cruces Field Office Sensitive

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George A. Ortega
Santa Fe, NM

December 2, 1998

Attn. Theresa Hanley
Bureau of Land Management
Las Cruces Field Office
1800 Marquess
Las Cruces, NM 88005

RE: Developing a RMPA to the White Sands Resource Management Plan to address fluid minerals
leasing in Sierra and Otero Counties. 1610 (03000).
NMGF No. 6534

Dear Ms. Hanley:

The Department of Game and Fish (Department) has reviewed the Bureau of Land Management's (BLM) scoping notice for fluid mineral leasing and development on public land in Sierra and Otero counties. The Department's concerns regard impacts on big game, small game, threatened, endangered, and sensitive, species habitats. One of our primary concerns is the potential impact of oil and gas mining activities on potential bighorn sheep transplant sites.

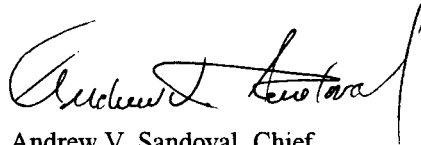
Free-ranging populations of desert bighorn sheep number 200 statewide and are distributed among six populations. No population currently exceeds 100 individuals. The Caballo, Sacramento, and Guadalupe mountains are considered potential release sites. Desert bighorn populations are not secure and remain vulnerable to innumerable impacts. The Department is still far from reaching our de-listing goal of 500 desert bighorn sheep distributed among three geographically separate populations or metapopulations, each of which numbers at least 100 sheep. Our goals are further described in *New Mexico's Long Range Plan for Desert Bighorn Sheep Management 1995-2002* (NMGF 1995).

The available literature indicates that bighorn may temporarily abandon habitat due to increased human activity resulting from mining operations, which could be critical if mining occurs on lambing grounds or water sources (Leslie and Douglas 1980; Campbell and Remington 1981). Roads built or improved for mining or other activities may provide access to previously undisturbed areas and increase potential negative impacts of people in bighorn habitat (McQuivey 1978). In the Grand Resource Area in Utah, improvement of county roads in remote, critical bighorn ranges led to increased use by hikers, mountain bikers, commercial tours, and rock climbers in bighorn habitat (BLM 1993). Lastly, roads fragment habitat that may be important for inter-mountain movements. We have similar concerns about the potential impacts of increasing human disturbance on other wildlife species, especially mule deer, antelope and small game

species, as these areas have good populations that produce a huntable surplus.

Included for your use is a list of threatened, endangered, and sensitive species existing in Sierra and Otero Counties. Thank you for the opportunity to comment on this scoping packet. Please contact Patrick Snyder, Southwest Area Wildlife/Habitat Specialist, at (505) 522-9796 if you have any questions for Sierra County or Michael Massy, Southeast Area Habitat Specialist, at (505) 624-6135 if you have any questions for Otero County.

Sincerely,



Andrew V. Sandoval, Chief
Conservation Services Division

Bureau of Land Management (BLM). 1993. City Slickers II Environmental Assessment. Ut-068-93-108. Grand Resource Area, Moab District Office. Moab, Utah. July 1993

Campbell, B. H. and R. Remington. 1981. Influence of construction activities on water use patterns of desert bighorn sheep. Wildl. Soc. Bull. 9:63-65.

Leslie, D. M., Jr. and C. L. Douglas. 1980. Human disturbance at water sources of desert bighorn sheep. Wildl. Soc. Bull. 8:284-290.

McQuivey, R. P. 1978. The desert bighorn sheep of Nevada. Nevada Dep. of Fish and Game Biol. Bull. 6, Reno. 81pp.

New Mexico Department of Game and Fish. 1995. New Mexico's long range plan for desert bighorn sheep management 1995-2002. Final Report. Fed. Aid in Wildl. Restor. Proj. W-127-R10. New Mexico Department of Game and Fish, Santa Fe. 40pp.

AVS/PS/af

cc: Lieutenant Governor Walter Bradley
Field Supervisor Ecological Services, USFS
Jerry A. Maracchini (Director, NMGF)
Scott Brown (Assistant Director, NMGF)
Steve Henry (Chief SW Area Operations, NMGF)
Mike Bell (Chief SE Area Operations, NMGF)
Jim Bailey (Assistant Chief, CSD, NMGF)
Amy Fisher (Assistant Chief, CSD, NMGF)
Patrick Snyder (SW Area Wildlife/Habitat Specialist, NMGF)
Michael Massey (SE Habitat Specialist, NMGF)
Eric Rominger (Bighorn Sheep Contractor, NMGF)

NEW MEXICAN WILDLIFE of CONCERN



STATUS & DISTRIBUTION

STATE OF NEW MEXICO: THREATENED, ENDANGERED, SENSITIVE
USFWS: THREATENED, ENDANGERED, CANDIDATE, PROPOSED, SPECIES OF CONCERN
US BUREAU OF LAND MANAGEMENT: SENSITIVE
US FOREST SERVICE: SENSITIVE
EXTIRPATED FROM NEW MEXICO
US CITES LISTED
HARVESTABLE
EXTINCT

State-wide lists: pages 3-13
County lists: pages 14-66

TABLE KEY

FWS ESA	US FISH & WILDLIFE SERVICE; ENDANGERED SPECIES ACT
NM WCA	NEW MEXICO; WILDLIFE CONSERVATION ACT
FS R3	US FOREST SERVICE; REGION 3, NEW MEXICO & ARIZONA
BLM NM	US BUREAU OF LAND MANAGEMENT, NEW MEXICO
NM Sen	NEW MEXICO; SENSITIVE (INFORMAL)
FWS SOC	US FISH & WILDLIFE SERVICE; SPECIES OF CONCERN (INFORMAL)
E	ENDANGERED
T	THREATENED
P	PROPOSED
C	CANDIDATE
R	RESTRICTED
A	THREATENED or ENDANGERED based on SIMILARITY OF APPEARANCE
s	SENSITIVE and SPECIES OF CONCERN (SOC)

ADDITIONAL INFORMATION

COMPLETE SPECIES ACCOUNTS: Information pertaining to taxonomy, status, distribution, habitat, environmental association, food habits, management practices and references for all vertebrates and selected invertebrates in New Mexico is in a database, the Biota Information System Of New Mexico (BISON-M) and maintained by the New Mexico Department of Game and Fish, Conservation Services Division. All accounts are available on the Internet World Wide Web at:

<http://www.fw.vt.edu/fishex/states/nm.htm>

or contact Jon Klingel
Conservation Services Division
New Mexico Department of Game & Fish
P.O. Box 25112
Santa Fe, New Mexico 87504

voice:505-827-9912 fax:505-827-9956
e-mail: j_klingel@gmfsh.state.nm.us

Or contact the New Mexico Department of Game and Fish, Endangered Species Program in Santa Fe at (505) 827-9904.

Information on federal status species is provided as a courtesy only. We suggest you contact the indicated federal agency for specifics regarding the status of these species. Offices: USFWS, Ecological Services Office, Albuquerque; US Forest Service Region 3 Office, Albuquerque; and US Bureau of Land Management State Office, Santa Fe.

New Mexican Wildlife of Concern - Otero County

Common Name.....	SCIENTIFIC NAME.....	FWS..	NM...	FS.	BLM..	NM...	FWS.
		ESA	WCA	R3	NM	Sen	SOC
Rio Grande Cutthroat Trout	<i>Oncorhynchus clarki virginalis</i>	-	-	S	-	S	-
Rio Grande Chub	<i>Gila pandora</i>	-	-	-	-	S	-
White Sands Pupfish	<i>Cyprinodon tularosa</i>	-	T	-	-	-	S
Sacramento Mountain Salamander	<i>Aneides hardii</i>	-	T	S	-	-	S
Northern Leopard Frog	<i>Rana pipiens</i>	-	-	S	-	-	-
Bleached Earless Lizard	<i>Holbrookia maculata ruthveni</i>	-	-	-	-	S	-
Texas Horned Lizard	<i>Phrynosoma cornutum</i>	-	-	S	S	-	S
White Sands Prairie Lizard	<i>Sceloporus undulatus cowlesi</i>	-	-	-	-	S	-
Little White Whiptail	<i>Cnemidophorus inornatus gypsi</i>	-	-	-	-	S	-
Desert Kingsnake	<i>Lampropeltis getula splendida</i>	-	-	S	-	-	-
Texas Longnose Snake	<i>Rhinocheilus lecontei</i>	-	-	S	-	-	-
Mottled Rock Rattlesnake	<i>Crotalus lepidus lepidus</i>	-	T	S	-	-	-
Desert Massasauga	<i>Sistrurus catenatus edwardsii</i>	-	-	S	-	-	-
Brown Pelican	<i>Pelecanus occidentalis carolinensis</i>	E	E	S	-	-	-
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>	-	T	S	-	-	-
American Bittern	<i>Botaurus lentiginosus</i>	-	-	S	-	-	-
Snowy Egret	<i>Egretta thula brewsteri</i>	-	-	S	-	-	-
Black-crowned Night Heron	<i>Nycticorax nycticorax hoactli</i>	-	-	S	-	-	-
White-faced Ibis	<i>Plegadis chihi</i>	-	-	S	S	-	S
Osprey	<i>Pandion haliaetus carolinensis</i>	-	-	S	-	-	-
Mississippi Kite	<i>Ictinia mississippiensis</i>	-	-	S	-	-	-
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T	T	S	-	-	-
Northern Goshawk	<i>Accipiter gentilis</i>	-	-	S	S	S	S
Common Black-hawk	<i>Buteogallus anthracinus anthracinus</i>	-	T	S	-	-	-
Swainson's Hawk	<i>Buteo swainsoni</i>	-	-	S	-	-	-
Ferruginous Hawk	<i>Buteo regalis</i>	-	-	S	S	-	S
Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	E	E	S	-	-	-
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	E	T	S	-	-	-
Sora	<i>Porzana carolina</i>	-	-	S	-	-	-
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	-	-	S	-	-	-
Mountain Plover	<i>Charadrius montanus</i>	C	-	S	-	S	-
Black-necked Stilt	<i>Himantopus mexicanus</i>	-	-	S	-	-	-
Long-billed Curlew	<i>Numenius americanus americanus</i>	-	-	S	-	-	-
Interior Least Tern	<i>Sterna antillarum athalassos</i>	E	E	S	-	-	-
Black Tern	<i>Chlidonias niger surinamensis</i>	-	-	-	S	-	S
Common Ground-dove	<i>Columbina passerina pallescens</i>	-	E	S	-	-	-
Flammulated Owl	<i>Otus flammeolus</i>	-	-	S	-	-	-
Burrowing Owl	<i>Athene cucularia hypugaea</i>	-	-	-	S	-	S
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T	-	S	-	S	-
Elegant Trogon	<i>Trogon elegans canescens</i>	-	E	S	-	-	-
Belted Kingfisher	<i>Ceryle alcyon</i>	-	-	S	-	-	-
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	E	E	S	-	-	-
Loggerhead Shrike	<i>Lanius ludovicianus</i>	-	-	-	S	-	S
Bell's Vireo	<i>Vireo bellii</i>	-	T	S	-	-	-
Gray Vireo	<i>Vireo vicinior</i>	-	T	S	-	-	-
Gray Catbird	<i>Dumetella carolinensis ruficrissa</i>	-	-	S	-	-	-
American Redstart	<i>Setophaga ruticilla tricolora</i>	-	-	S	-	-	-
Baird's Sparrow	<i>Ammodramus bairdii</i>	-	T	S	S	-	S
Sprague's Pipit (no data)	<i>Anthus spragueii</i>	-	-	S	-	-	-
Varied Bunting	<i>Passerina versicolor</i>	-	T	S	-	-	-

New Mexican Wildlife of Concern - Otero County Page 2 of 2

Common Name.....	SCIENTIFIC NAME.....	FWS..	NM...	FS.	BLM..	NM...	FWS.
		ESA	WCA	R3	NM	Sen	SOC
Western Small-footed Myotis Bat	<i>Myotis ciliolabrum melanorhinus</i>	-	-	-	S	S	S
Occult Little Brown Myotis Bat	<i>Myotis lucifugus occultus</i>	-	-	S	S	S	S
Cave Myotis Bat	<i>Myotis velifer</i>	-	-	S	S	S	S
Long-legged Myotis Bat	<i>Myotis volans interior</i>	-	-	-	S	S	S
Fringed Myotis Bat	<i>Myotis thysanodes thysanodes</i>	-	-	-	S	S	S
Spotted Bat	<i>Euderma maculatum</i>	-	T	S	S	-	S
Pale Townsend's Big-eared Bat	<i>Plecotus townsendii pallescens</i>	-	-	S	S	S	S
Big Free-tailed Bat	<i>Nyctinomops macrotis</i>	-	-	-	S	S	S
Penasco Least Chipmunk	<i>Tamias minimus atristriatus</i>	-	E	S	-	-	-
Gray-footed Chipmunk	<i>Tamias canipes canipes</i>	-	-	-	S	-	S
Gray-footed Chipmunk	<i>Tamias canipes sacramentoensis</i>	-	-	-	S	S	S
Arizona Black-tailed Prairie Dog	<i>Cynomys ludovicianus arizonensis</i>	-	-	S	S	S	S
Guadalupe Pocket Gopher	<i>Thomomys bottae guadalupensis</i>	-	-	S	S	S	S
Botta's Pocket Gopher (subspecies)	<i>Thomomys bottae tularosae</i>	-	-	-	-	S	-
Desert Pocket Gopher	<i>Geomys arenarius brevirrostris</i>	-	-	-	-	-	S
Plains Pocket Mouse	<i>Perognathus flavescens gypsi</i>	-	-	-	-	S	-
Rock Pocket Mouse	<i>Chaetodipus intermedius ater</i>	-	-	-	-	S	-
New Mexican Jumping Mouse	<i>Zapus hudsonius luteus</i>	-	T	S	S	-	S
Ringtail	<i>Bassariscus astutus</i>	-	-	S	-	S	-
Western Spotted Skunk	<i>Spilogale gracilis</i>	-	-	-	-	S	-
Common Hog-nosed Skunk	<i>Conepatus mesoleucus</i>	-	-	-	-	S	-
Cloudcroft Checkerspot Butterfly	<i>Occidryas anicia cloudcrofti</i>	-	-	-	-	S	-

NATIVE WILDLIFE APPARENTLY NO LONGER OCCURRING IN OTERO COUNTY

Rock Squirrel	<i>Spermophilus variegatus tularosae</i>
Mexican Gray Wolf	<i>Canis lupus baileyi</i> (extirpated from NM)
Grizzly Bear	<i>Ursus arctos</i> (extirpated from NM)
Jaguar	<i>Panthera onca arizonensis</i>
Merriam's Elk	<i>Cervus elaphus merriami</i> (extinct)
Desert Bighorn Sheep	<i>Ovis canadensis mexicana</i>

New Mexican Wildlife of Concern - Sierra County

Common Name.....	SCIENTIFIC NAME.....	FWS..	NM...	FS.	BLM..	NM...	FWS.
		ESA	WCA	R3	NM	Sen	SOC
Rio Grande Cutthroat Trout	<i>Oncorhynchus clarki virginalis</i>	-	-	S	-	S	-
Gila Trout	<i>Oncorhynchus gilae</i>	E	T	S	-	-	-
Longfin Dace	<i>Agosia chrysogaster</i> (native to Gila basin only in NM)	-	-	-	S	-	S
Rio Grande Chub	<i>Gila pandora</i>	-	-	-	-	S	-
Rio Grande Sucker	<i>Catostomus plebeius</i>	-	-	S	-	-	-
White Sands Pupfish	<i>Cyprinodon tularosa</i>	-	T	-	-	-	S
Arizona Toad	<i>Bufo microscaphus microscaphus</i>	-	-	S	S	S	S
Chiricahua Leopard Frog	<i>Rana chiricahuensis</i>	C	-	S	-	S	-
Northern Leopard Frog	<i>Rana pipiens</i>	-	-	S	-	-	-
Big Bend Slider	<i>Trachemys gaigeae</i>	-	-	-	-	S	-
Texas Horned Lizard	<i>Phrynosoma cornutum</i>	-	-	S	S	-	S
Desert Kingsnake	<i>Lampropeltis getula splendida</i>	-	-	S	-	-	-
Texas Longnose Snake	<i>Rhinocheilus lecontei</i>	-	-	S	-	-	-
Desert Massasauga	<i>Sistrurus catenatus edwardsii</i>	-	-	S	-	-	-
Brown Pelican	<i>Pelecanus occidentalis carolinensis</i>	E	E	S	-	-	-
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>	-	T	S	-	-	-
Great Egret	<i>Ardea alba egretta</i>	-	-	S	-	-	-
Snowy Egret	<i>Egretta thula brewsteri</i>	-	-	S	-	-	-
White-faced Ibis	<i>Plegadis chihi</i>	-	-	S	S	-	S
Mississippi Kite	<i>Ictinia mississippiensis</i>	-	-	S	-	-	-
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T	T	S	-	-	-
Northern Goshawk	<i>Accipiter gentilis</i>	-	-	S	S	S	S
Northern Gray Hawk	<i>Asturina nitida maximus</i>	-	-	S	S	-	S
Common Black-hawk	<i>Buteogallus anthracinus anthracinus</i>	-	T	S	-	-	-
Swainson's Hawk	<i>Buteo swainsoni</i>	-	-	S	-	-	-
Ferruginous Hawk	<i>Buteo regalis</i>	-	-	S	S	-	S
Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	E	E	S	-	-	-
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	E	T	S	-	-	-
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	-	-	S	-	-	-
Mountain Plover	<i>Charadrius montanus</i>	C	-	S	-	S	-
Black Tern	<i>Chlidonias niger surinamensis</i>	-	-	-	S	-	S
Common Ground-dove	<i>Columbina passerina pallescens</i>	-	E	S	-	-	-
Elf Owl	<i>Micrathene whitneyi whitneyi</i>	-	-	S	-	-	-
Burrowing Owl	<i>Athene cucularia hypugaea</i>	-	-	-	S	-	S
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T	-	S	-	S	-
Lucifer Hummingbird	<i>Calothorax lucifer</i>	-	T	S	-	-	-
Belted Kingfisher	<i>Ceryle alcyon</i>	-	-	S	-	-	-
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	E	E	S	-	-	-
Loggerhead Shrike	<i>Lanius ludovicianus</i>	-	-	-	S	-	S
Bell's Vireo	<i>Vireo bellii</i>	-	T	S	-	-	-
Gray Vireo	<i>Vireo vicinior</i>	-	T	S	-	-	-
Sprague's Pipit	<i>Anthus spragueii</i>	-	-	S	-	-	-
Baird's Sparrow	<i>Ammodramus bairdii</i>	-	T	S	S	-	S
Varied Bunting	<i>Passerina versicolor</i>	-	T	S	-	-	-

New Mexican Wildlife of Concern - Sierra County Page 2 of 2

Common Name.....	SCIENTIFIC NAME.....	FWS..	NM...	FS.	BLM..	NM...	FWS.
		ESA	WCA	R3	NM	Sen	SOC
Western Small-footed Myotis Bat	<i>Myotis ciliolabrum melanorhinus</i>	-	-	-	S	S	S
Yuma Myotis Bat	<i>Myotis yumanensis yumanensis</i>	-	-	-	S	S	S
Occult Little Brown Myotis Bat	<i>Myotis lucifugus occultus</i>	-	-	S	S	S	S
Long-legged Myotis Bat	<i>Myotis volans interior</i>	-	-	-	S	S	S
Fringed Myotis Bat	<i>Myotis thysanodes thysanodes</i>	-	-	-	S	S	S
Long-eared Myotis Bat	<i>Myotis evotis evotis</i>	-	-	-	S	S	S
Pale Townsend's Big-eared Bat	<i>Plecotus townsendii pallescens</i>	-	-	S	S	S	S
Gunnison's Prairie Dog	<i>Cynomys gunnisoni</i>	-	-	-	-	S	-
Botta's Pocket Gopher (subspecies)	<i>Thomomys bottae opulentus</i>	-	-	-	-	S	-
Pecos River Muskrat	<i>Ondatra zibethicus ripensis</i>	-	-	-	S	S	S
Ringtail	<i>Bassariscus astutus</i>	-	-	S	-	S	-
Common Hog-nosed Skunk	<i>Conepatus mesoleucus</i>	-	-	-	-	S	-
Chihuahuan Pronghorn	<i>Antilocapra americana mexicana</i>	-	-	S	-	-	-
Desert Bighorn Sheep	<i>Ovis canadensis mexicana</i> (endangered pops)	-	E	S	-	-	-
Mineral Creek Mountainsnail	<i>Oreohelix pilsbryi</i>	-	T	-	-	-	S
Southwest. Pearly Checkerspot Butterfly	<i>Charidryas acastus sabina</i>	-	-	-	-	-	S
Obsolete Viceroy Butterfly	<i>Basilarchia archippus obsoleta</i>	-	-	S	-	-	-

NATIVE WILDLIFE APPARENTLY NO LONGER OCCURRING IN SIERRA COUNTY

American Eel	<i>Anguilla rostrata</i> (extirpated from NM)
Rio Grande Silvery Minnow	<i>Hybognathus amarus</i>
Speckled Chub	<i>Macrhybopsis aestivalis aestivalis</i>
Loach Minnow	<i>Rhinichthys cobitis</i>
Blue Sucker	<i>Cycleptus elongatus</i>
Gray Redhorse	<i>Moxostoma congestum</i>
Arizona Black-tailed Prairie Dog	<i>Cynomys ludovicianus arizonensis</i>
Hot Springs Cotton Rat	<i>Sigmodon fulviventer goldmani</i> (extinct)
Mexican Gray Wolf	<i>Canis lupus baileyi</i> (extirpated from NM)
Grizzly Bear	<i>Ursus arctos</i> (extirpated from NM)
Jaguar	<i>Panthera onca arizonensis</i>
Merriam's Elk	<i>Cervus elaphus merriami</i> (extinct)



NEW MEXICO ENERGY, MINERALS & NATURAL RESOURCES DEPARTMENT

Jennifer A. Salisbury
CABINET SECRETARY

11 December 1998

Leslie Ellwood
Dames and Moore
633 Seventeenth Street, Suite 2500
Denver, Colorado 80202-3625

Dear Ms. Ellwood:

This letter is regarding your request for updated information on rare plants in Sierra and Otero Counties, New Mexico. I am not aware of any new rare plant records for Sierra County. Three new plant taxa have recently been discovered in southeastern Otero County. Two are new varieties (in press) that occur on gypsum outcrops in townships T20S R17E, T21S R18E and T22S R18E. They will be named *Anulocaulis lelosolenus* var. *howardii* and *Mentzelia humilis* var. *guadalupensis*. Look for these new taxa to be published in the autumn 1999 edition of the journal *Sida* by Richard Spellenberg and Thomas Wooten. The third is a undescribed *Cryptantha* sp. nov. that is presently known only from Upper Dog Canyon in township T25S R20E. I will be conducting additional field surveys for this plant next May in the Brokeoff Mountains and intend to submit an article with its name and description to *Sida* sometime next summer. Therefore, this new species will not have a published name until about two years from now. Nevertheless, it is a very rare plant and should be considered in land management plans. If I can be of further help, contact me at (505)827-7865.

Best Regards,

A handwritten signature in black ink, appearing to read "R. Sivinski".

Robert Sivinski
bslvinski@state.nm.us



United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

January 5, 1999

Cons#2-22-98-1-109

Leslie Ellwood
Project Biologist
Dames & Moore
633 Seventeenth Street, Suite 2500
Denver, Colorado 80202-3625

Dear Ms. Ellwood:

This responds to your letter dated November 20, 1998, requesting information on species Federally-listed or proposed to be listed as threatened or endangered occurring in Otero and Sierra Counties, New Mexico. It is our understanding that Dames & Moore, in conjunction with the Bureau of Land Management (BLM), is preparing an Environmental Impact Statement (EIS), as per National Environmental Policy Act guidance for an Fluid Minerals Resource Management Plan amendment to the existing Resource Management Plan (RMP). The proposed amendment describes fluid minerals resource planning activities to specifically address heightened interest in oil, gas, and geothermal leasing/development of BLM-managed public lands within the planning area (Otero and Sierra County).

National Environmental Policy Act requirements should be integrated with other planning and environmental review procedures so that all such procedures run concurrently rather than consecutively. As you may be aware, the U.S. Fish and Wildlife Service (Service) has recommended programmatic consultation over the effects of oil and gas leasing activities on federally-listed species (biological opinion on the Caballo RMP to Area Manager dated April 28, 1997; Cons#2-22-96-F-329). Additional information and resource concerns identified by the Service within the planning area may be found in the aforementioned biological opinion to assist in the development of the EIS document. The EIS may provide adequate consideration of Federally-listed species concerns for the selected alternative, consistent with the purposes of the Endangered Species Act (Act).

Although site-specific lists are unavailable, we have enclosed a current list of federally-endangered, threatened, candidate species, and species of concern that may be found in Otero and Sierra Counties. Under the Act, it is the responsibility of the Federal action agency or their designated representative to determine whether the proposed action "may affect" any listed or proposed species. We routinely recommend species-specific surveys during the proper breeding/flowering season and within appropriate habitat to address project-related impacts on these species. Although candidate species are not protected under the Act, the Service is required to monitor their status. If any candidate species or species of concern decline significantly, they could become listed

Ms. Leslie Ellwood

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as threatened or endangered. Therefore, actions which may contribute to the listing of these species should be avoided. We recommend including candidates and species of concern in any necessary site surveys and/or assessments.

As provided in the Act at Section 7(a)(1), all Federal agencies shall, in consultation, utilize their authorities in the furtherance of the purposes of the Act by carrying out programs for the conservation of endangered and threatened species. Therefore, as we are concerned about ensuring adverse impacts from the proposed activities are sufficiently minimized or eliminated; we are also concerned about how such resource development activities occurring within the planning area will protect and promote the recovery of listed species. For example, the planning area, which includes Otero Mesa, contains large blocks of native yucca-grassland habitat which may be essential for the recovery of the federally-endangered northern aplomado falcon (*Falco femoralis septentrionalis*). Depending on the location, intensity, and/or proper implementation of proposed resource development activities, such actions may prevent the reestablishment of this species into one of the few remaining suitable habitat areas in the U.S. due to habitat fragmentation or alteration. Habitat loss, in part, is a factor originally associated with the decline and subsequent listing of this falcon as endangered.

The EIS should, at a minimum, address all direct, indirect, and cumulative impacts associated with the proposed actions on important fish and wildlife, such as federally-listed species and/or their habitats. This should include efforts to minimize or eliminate adverse impacts on such resources. Cumulative impacts should include all past, present, and reasonably foreseeable future actions of Federal, State, and private activities in and/or near the planning area forming the environmental baseline. In addition, a range of viable alternatives including the no-action alternative should be explored and objectively evaluated to provide clear options to the decisionmaker and the public.

We appreciate the opportunity to provide important pre-project planning information to assist in adequate consideration of New Mexico's unique heritage of rare wildlife and habitats. We recommend contacting the New Mexico Department of Game and Fish and the New Mexico Energy, Minerals, and Natural Resources Department, Forestry and Resources Conservation Division for information concerning fish, wildlife, and plants of State concern. We look forward to reviewing a copy of the draft EIS, when it becomes available. If we can be of any further assistance, please contact Chris Perez of my staff at the letterhead address above or at telephone extension 119.

Sincerely,



Jennifer Fowler-Propst
Field Supervisor

Ms. Leslie Ellwood

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Enclosure

cc: (w/o enc)

Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico

Director, New Mexico Forestry and Resources Conservation Division, Santa Fe, New Mexico

Mike Howard, BLM, Las Cruces, New Mexico

Threatened, Endangered, Candidate Species,
and Species of Concern
Otero and Sierra counties, New Mexico
October 27, 1999

Otero

Northern aplomado falcon, Falco femoralis septentrionalis, E
Kuenzler hedgehog cactus, Echinocereus fendleri var. kuenzleri, E
Sacramento prickly poppy, Argemone pleiacantha ssp. pinnatisecta, E
Todsens's pennyroyal, Hedeoma todsenii, E
Southwestern willow flycatcher, Empidonax traillii extimus, E
Interior least tern, Sterna antillarum athalassos, E
Black-footed ferret, Mustela nigripes, E**
Bald eagle, Haliaeetus leucocephalus, T
Mexican spotted owl, Strix occidentalis lucida, T
Sacramento Mountains thistle, Cirsium vinaceum, T
Mountain plover, Charadrius montanus, PT
Big free-tailed bat, Nyctinomops macrotis (= Tadarida m., T. molossa), SC
Black-tailed prairie dog, Cynomys ludovicianus, SC
Cave myotis, Myotis velifer, SC
Desert pocket gopher, Geomys bursarius arenarius, SC
Fringed myotis, Myotis thysanodes, SC
Gray-footed chipmunk, Tamias canipes, SC
Greater western mastiff bat, Eumops perotis californicus, SC
Guadalupe southern pocket gopher, Thomomys umbrinus guadalupensis, SC
Long-legged myotis, Myotis volans, SC
New Mexican meadow jumping mouse, Zapus hudsonius luteus, SC
Occult little brown bat, Myotis lucifugus occultus, SC
Pale Townsend's (= western) big-eared bat, Plecotus townsendii pallescens, SC
Small-footed myotis, Myotis ciliolabrum, SC
Spotted bat, Euderma maculatum, SC
White Sands woodrat, Neotoma micropus leucophaea, SC
American peregrine falcon, Falco peregrinus anatum, SC
Arctic peregrine falcon, Falco peregrinus tundrius, SC (S/A)
Baird's sparrow, Ammodramus bairdii, SC
Black tern, Chlidonias niger, SC
Ferruginous hawk, Buteo regalis, SC
Loggerhead shrike, Lanius ludovicianus, SC
Northern goshawk, Accipiter gentilis, SC
Western burrowing owl, Athene cunicularia hypugaea, SC
White-faced ibis, Plegadis chihi, SC
Yellow-billed cuckoo, Coccyzus americanus, SC
White Sands pupfish, Cyprinodon tularosa, SC
Sacramento mountain salamander, Aneides hardii, SC
Texas horned lizard, Phrynosoma cornutum, SC
Sacramento Mountains checkerspot butterfly, Euphydryas anicia cloudcrofti, SC
Sacramento Mountains silverspot butterfly, Speyeria atlantis capitanensis, SC

Otero, Cont'd

Sacramento Mountains blue butterfly, Icaricia icarioides (new subspecies), SC
 Alamo beardtongue, Penstemon alamosensis, SC
 Desert night-blooming cereus, Cereus greggii var. greggii, SC
 Goodding's onion, Allium gooddingii, SC
 Guadalupe rabbitbrush, Chrysothamnus nauseosus var. texensis, SC
 Gypsum scalebroom, Lepidospartum burgessii, SC
 Sierra Blanca cliffdaisy, Chaetopappa elegans, SC
 Villard's pincushion cactus, Escobaria villardii, SC
 Wright's marsh thistle, Cirsium wrightii, SC

Sierra

Northern aplomado falcon, Falco femoralis septentrionalis, E
 Southwestern willow flycatcher, Empidonax traillii extimus, E
 Todsens's pennyroyal, Hedeoma todsenii, E w/CH
 Gila trout, Oncorhynchus gilae, E
 Black-footed ferret, Mustela nigripes, E**
 Bald eagle, Haliaeetus leucocephalus, T
 Mexican spotted owl, Strix occidentalis lucida, T
 Whooping crane, Grus americana, XN
 Chiricahua leopard frog, Rana chiricahuensis, C
 Black-tailed prairie dog, Cynomys ludovicianus, SC*
 Fringed myotis, Myotis thysanodes, SC
 Greater western mastiff bat, Eumops perotis californicus, SC
 Long-eared myotis, Myotis evotis, SC
 Long-legged myotis, Myotis volans, SC
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 Yuma myotis, Myotis yumanensis, SC
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 Arctic peregrine falcon, Falco peregrinus tundrius, SC (S/A)
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 Western burrowing owl, Athene cunicularia hypugaea, SC
 White-faced ibis, Plegadis chihi, SC

Sierra, cont'd

Yellow-billed cuckoo, Coccyzus americanus, SC
 Desert sucker, Catostomus clarki, SC
 Longfin dace, Agosia chrysogaster*, SC
 Sonora sucker, Catostomus insignis, SC
 Speckled dace, Rhinichthys osculus (Gila drainage), SC
 White Sands pupfish, Cyprinodon tularosa, SC
 Arizona southwestern toad, Bufo microscaphus microscaphus, SC
 Texas horned lizard, Phrynosoma cornutum, SC
 Desert viceroy butterfly, Limenitis archippus obsoleta, SC
 Mineral Creek mountainsnail, Oreohelix pilsbryi, SC
 Duncan's cory cactus, Coryphantha duncanii, SC
 Pinos Altos fameflower, Talinum humile, SC
 Sandhill goosefoot, Chenopodium cycloides, SC

Index

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PE w/CH	=	Proposed Endangered with critical habitat
T	=	Threatened
PT	=	Proposed Threatened
PT w/CH	=	Proposed Threatened with critical habitat
PCH	=	Proposed critical habitat
C	=	Candidate Species (taxa for which the Service has sufficient information to propose that they be added to list of endangered and threatened species, but the listing action has been precluded by other higher priority listing activities).
SC	=	Species of Concern (taxa for which further biological research and field study are needed to resolve their conservation status)
S/A	=	Similarity of Appearance
*	=	Introduced population
XN	=	Nonessential experimental
**	=	Survey should be conducted if project involves impacts to prairie dog towns or complexes of 200-acres or more for the Gunnison's prairie dog (<u>Cynomys gunnisoni</u>) and/or 80-acres or more for any subspecies of Black-tailed prairie dog (<u>Cynomys ludovicianus</u>). A complex consists of two or more neighboring prairie dog towns within 4.3 miles (7 kilometers) of each other.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

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LAS CRUCES

October 27, 1999

Cons. #2-22-99-I-478

Memorandum

To: Field Manager, Bureau of Land Management (BLM), Las Cruces, New Mexico
(Attn: Mike Howard)

From: Field Supervisor, New Mexico Ecological Services Field Office, U.S. Fish and
Wildlife Service (Service), Albuquerque, New Mexico

Subject: Draft Resource Management Plan Amendment (RMPA)/Environmental Impact
Statement: Fluid Minerals Leasing Sierra/Otero Counties, New Mexico

This responds to your request for comments on a draft outline of RMPA alternatives provided during a meeting held at our field office on September 15, 1999. Specifically, we were asked to focus on the adequacy of the range of alternatives in addressing important fish and wildlife resources, including federally-listed species. The purpose of the RMPA is to address future oil, gas, and geothermal leasing and development on public lands in Sierra and Otero counties involving 2.4 million surface acres administered by the BLM and 3.7 acres of Federal mineral estate. Although environmental planning documents were prepared in the 1980s for minerals leasing within that area, increased nominations for oil/gas leasing, particularly in species sensitive areas has prompted a re-evaluation.

Due to some recent species status changes, we have enclosed an updated list of federally-endangered, threatened, candidate species, and species of concern that may occur within the study area. Although candidate species are not protected under the Act, the Service is required to monitor their status. If any candidate species or species of concern decline significantly, they could become listed as threatened or endangered. Therefore, actions which may contribute to the listing of these species should be avoided. We recommend including candidates and species of concern in any necessary site surveys and/or assessments.

It is our understanding that the RMPA will determine where and under what conditions oil, gas, and geothermal leasing, exploration, and development will be permitted within the 20-year plan period. In addition, these determinations will identify certain stipulations attached to minerals leases for the adequate consideration for sensitive resources. Three alternatives were submitted for our review and are defined as follows:

No-action alternative--the continuation of management according to the RMP on a case-by-case National Environmental Policy Act (NEPA) analysis; *Alternative A*--management emphasis on mitigation of impacts which would predictably result from case-by-case NEPA analysis and; *Alternative B*--management emphasis on avoidance of impacts and restrictions which would emphasize resource protection. The preferred alternative was identified as Alternative A.

According to 40 CFR part 1502.14, agencies must rigorously explore and evaluate all reasonable alternatives, including those alternatives outside the jurisdiction of the lead agency. NEPA alternatives should provide for a full spectrum of analysis and provide clear choices. In this case, all three alternatives appear closely related partly because all three choices result in the implementation of the proposed action. The preferred alternative provides for an emphasis on mitigation of impacts associated with the no-action alternative while Alternative B emphasizes resource protection. However, mitigation should probably not be regarded as a first step or as an emphasis of any particular alternative. Mitigation should be the last step in a process that begins first with adequate planning to avoid the impact.

The Service recommends an additional alternative that would include a true "no-action" alternative (e.g., no further mineral leasing activities). Inclusion of this analysis should provide a benchmark in order to allow decisionmakers the opportunity to compare the full magnitude of the environmental effects of each alternative, particularly in light of numerous identified resource issues and ongoing uses within the study area. And, this would exemplify an alternative outside the jurisdiction of the agency, which must be satisfied according to 40 CFR Part 1502.14. All of the alternatives, particularly the preferred alternative, should specifically discuss the range and types of stipulations available that would result in a clearer separation of each alternative. It is our understanding that the majority of interest in oil/gas leasing within the study area is on or near Otero Mesa, Otero County, New Mexico. This may also affect the choice of alternatives and should be addressed.

As indicated in our biological opinion dated April 28, 1997, on the BLM's resource management plan (Cons#2-22-96-F-329), the Service is primarily concerned with the existing effects from ongoing livestock grazing combined with habitat loss and fragmentation associated with extensive oil and gas leasing. This concern applies to desert grassland species that would include the federally-endangered northern aplomado falcon (*Falco femoralis septentrionalis*). Perhaps the most important decimating factor attributed to the decline of the aplomado falcon in the U.S. is habitat loss/degradation. In the U.S., Otero Mesa is one of the few remaining large expanses (particularly on public lands) of remnant Chihuahuan desert grassland. In the Southwest, the aplomado falcon depends on the desert grassland ecosystem and wherever it remains, is essential habitat for the falcon. Therefore, Otero Mesa (including McGregor Range) is a high priority recovery area for the falcon because of the combination of its overall size, relatively unfragmented natural condition, and its proximity to breeding aplomado populations in nearby Mexico. The falcon has historically (1917) and recently

(1991, 1993, 1997, and 1999) been reported within Otero County. The 1999 sighting was confirmed on Otero Mesa by a qualified ornithologist.

The 1990 aplomado falcon recovery plan states that, "...suitable habitat in the United States and Mexico should be identified and protected..." and goes on to stress that, "Particular attention should be directed toward suitable habitat on public lands." Section 7(a)(1) of the Act calls for all Federal agencies to utilize their authorities to further the purposes of the Act by carrying out programs for the conservation of endangered and threatened species. To date, no such programs are in effect for areas such as Otero Mesa that are now under increased pressure for oil/gas development. Additionally, according to 40 CFR Part 1500.1, the NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

We strongly advise the BLM to develop a conservation program for listed species consistent with Section 7(a)(1) within the study area with an emphasis on the endangered aplomado falcon and Otero Mesa. The elements of such a plan could include delineating areas important for aplomado falcon recovery as well as other sensitive species/resources as areas of critical environmental concern. This should also assist you in compliance with Section 7(a)(2) (consultation requirement). Baseline analyses or the "affected environment" should take into account ongoing livestock grazing programs and associated facilities. Cumulative effects assessments should be projected over the plan's 20-year period. Assuming minerals leasing will be undertaken, a reasonable effort should be made to determine at what level of oil/gas development and other human activity may be tolerated without adversely affecting the aplomado falcon or the integrity of its habitat. Other special status and/or listed species concerns in the remaining portions of the analysis area should be addressed (if not already considered within the RMP) with respect to the proposed action.

We appreciate the opportunity to provide comments and look forward to continued cooperation on compliance with the National Environmental Policy Act and the Endangered Species Act. In reference to the above, please contact Chris Perez of my staff at (505) 346-2525, extension 119.



Jennifer Fowler-Propst

Attachment

cc (w/o attachment):

Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico

Threatened, Endangered, Candidate Species,
and Species of Concern
Otero and Sierra Counties, New Mexico
January 5, 1999

Otero

Northern aplomado falcon, Falco femoralis septentrionalis, E
 American peregrine falcon, Falco peregrinus anatum, E
 Arctic peregrine falcon, Falco peregrinus tundrius, E(S/A)
 Southwestern willow flycatcher, Empidonax traillii extimus, E
 Interior least tern, Sterna antillarum athalassos, E
 Kuenzler hedgehog cactus, Echinocereus fendleri var. kuenzleri, E
 Sacramento prickly poppy, Argemone pleiacantha ssp. pinnatisecta, E
 Todsens's pennyroyal, Hedeoma todsenii, E
 Black-footed ferret, Mustela nigripes, E
 Bald eagle, Haliaeetus leucocephalus, T
 Mexican spotted owl, Strix occidentalis lucida, T
 Sacramento Mountains thistle, Cirsium vinaceum, T
 Arizona black-tailed prairie dog, Cynomys ludovicianus arizonensis, SC
 Big free-tailed bat, Nyctinomops macrotis (= Tadarida m., T. molossa), SC
 Cave myotis, Myotis vellifer, SC
 Desert pocket gopher, Geomys bursarius arenarius, SC
 Fringed myotis, Myotis thysanodes, SC
 Gray-footed chipmunk, Tamias canipes, SC
 Greater western mastiff bat, Eumops perotis californicus, SC
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 Western burrowing owl, Athene cunicularia hypuga, SC
 White-faced ibis, Plegadis chihi, SC
 Desert sucker, Catostomus clarki, SC
 Longfin dace, Agosia chrysogaster*, SC
 Sonora sucker, Catostomus inslanis, SC

Sierra, continued

Speckled dace, Rhinichthys osculus (Gila drainage), SC
 White Sands pupfish, Cyprinodon tularosa, SC
 Arizona southwestern toad, Bufo microscaphus microscaphus, SC
 Texas horned lizard, Phrynosoma cornutum, SC
 Mineral Creek mountainsnail, Oreohelix pilsbryi, SC
 Duncan's cory cactus, Coryphantha duncanii, SC
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 Sandhill goosefoot, Chenopodium cycloides, SC

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*	=	Introduced population
XN	=	Nonessential experimental

GLOSSARY

Abandonment—Termination of fluid minerals operations, production operations, removal of facilities, plugging of the well bore, and reclamation of surface disturbances.

Affected Environment—Surface or subsurface resources (including social and economic elements) within or adjacent to a geographic area that potentially could be affected by gas development and production activities. The environment of the area to be affected or created by the alternatives under consideration. (40 CFR 1502.15)

A-weighted—A weighting function applied to the noise spectrum, which approximates the response of the human ear.

Alkalinity—Quantity and type of compounds in water that collectively cause a pH shift to alkalinity.

Allotment (Range)—A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under management of an authorized agency.

Alluvial Plains—Floodplains produced by the filling of a valley bottom and consisting of fine mud, sand, or gravel.

Alternative—A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of a number of plans or projects proposed for decision-making.

Ambient (air)—The surrounding atmospheric conditions to which the general public has access.

Analysis Area—For this RMPA/EIS, refers to lands that overlie Federal fluid minerals, and exclude areas that are closed to leasing by statute and lands administered by surface management agencies other than BLM.

Animal Unit Months (AUM)—Amount of forage required to sustain a cow/calf unit (one cow and one calf) for one month.

Annular—Having the form of a ring; ring-shaped.

Application—A written request, petition, or offer to lease lands for the purpose of fluid minerals exploration and/or right-of-extraction.

Aquifer—A water-bearing layer of permeable rock, sand or gravel. A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to conduct groundwater and yield large quantities of water to wells and springs.

Areas of Critical Environmental Concern (ACEC)—A BLM designation pertaining to areas where specific management attention is needed to protect and prevent irreparable damage to important historical, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards.

Arroyo—A term applied in the arid and semiarid regions of the southwestern United States to the small, deep, flat-floored channel or gully of an ephemeral stream or of an intermittent stream usually with vertical or steeply cut banks of unconsolidated material at least 2 feet (60 centimeters) high; it is usually dry, but may be transformed into a temporary watercourse or short-lived torrent after heavy rainfall.

Aspect—The direction in which a slope faces.

Barite (BaSO₄)—A mineral used to increase the weight of the drilling mud.

Basin—A depressed area having no surface outlet (*topographic basin*); a physiographic feature or subsurface structure that is capable of collecting, storing, or discharging water by reason of its shape and the characteristics of its confining material (*water*); a depression in the earth's surface, the lowest part often filled by a lake or pond (*lake basin*); a part of a river or canal widened (*drainage, river, stream basin*)

Basin and Range—Topography characterized by a series of tilted fault block mountain ranges and broad intervening basins.

Basin and Range Physiographic Province—A province in the southwestern United States characterized by a series of tilted fault blocks forming longitudinal ridges or mountains and broad intervening basins.

Benthic—Of, pertaining to, or living in or on the bottom of a waterbody.

Bentonite—A naturally occurring clay used to keep the cuttings in suspension as they move up the bore hole.

Big Game—Large species of wildlife that are hunted, such as elk, deer, bighorn sheep, and pronghorn antelope.

Biodiversity—The diversity of living organisms considered at all levels of organization including genetics, species, and higher taxonomic levels, and the variety of habitats and ecosystems, as well as the processes occurring therein.

Biogenic Rock—An organic rock produced directly by the physiological activities of living organisms, either plant or animal; e.g., coral reefs, shelly limestone, pelagic ooze, coal, peat.

Bioherm—A mound-, dome-, lens-, or reef-like or otherwise circumscribed mass of rock built up by, and composed almost exclusively of, the remains of sedentary organisms (corals, algae, foraminifers, mollusks, gastropods, stromatopods) and enclosed or surrounded by rock of different lithology.

Blowout—An uncontrolled expulsion of gas, oil, or other fluids from a drilling well. A blowout occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid and when blowout prevention equipment is absent or fails.

Bored Crossing—A subterranean crossing of a road, railway, river, or other obstacle, by a pipeline, transmission line, or other transport system.

Bradenhead Testing—The bradenhead is the portion of the wellhead that is in communication with the annular volume between the surface casing and the next smaller casing string. Conceptually, if there is positive pressure at the bradenhead, this indicates that a casing leak or an inadequate cement job could exist on a well.

Brine—A highly saline solution.

Bureau of Indian Affairs—An agency of the Department of the Interior responsible for encouraging and assisting Indian people to manage their own affairs under the trust relationship to the Federal government; to facilitate, with the maximum involvement of Indian people, full development of their human and natural resource potential, and promote self-determination by using the skills and capabilities of Indian people in the direction and management of programs for their benefit.

Bureau of Land Management—An agency of the Department of the Interior responsible for managing most Federal government subsurface minerals. It has surface management responsibility for Federal lands designated under the Federal Land Policy and Management Act of 1976.

Cambrian—The oldest of the periods of the Paleozoic Era; also the system of strata deposited during that period.

Carbonaceous—Coaly; pertaining to, or composed largely of, carbon.

Casing—Steel pipes of varying diameter and weight, joined together by threads and couplings, "inserted" into the well bore for the purpose of supporting the walls of the well and preventing them from caving in. Surface casing is inserted from the ground surface to approximately 250 feet (76 metres), production casing is inserted to the total depth of the well (smaller diameter pipe than surface casing), cemented in place and latter perforated for production.

Casual Use—Activities that ordinarily lead to no significant disturbance of Federal lands, resources, or improvements.

Centralizer—A device secured around the casing at various intervals to center the casing in the hole and provide a uniform cement sheath around the casing.

Christmas Tree—An assemblage of valves, located at the top of casing, from which tubing in the well is suspended.

Clean Air Act—Federal legislation governing air pollution. Prevention of Significant Deterioration above legally established levels include the following:

Class I - minimal additional deterioration in air quality (certain national parks and wilderness areas).

Class II - moderate additional deterioration in air quality (most lands).

Class III - greater deterioration for planned maximum growth (industrial areas).

Coal—A readily combustible rock containing more than 50 percent weight and more than 70 percent by volume of carbonaceous material including inherent moisture, formed from compaction and induration of variously altered plant remains similar to those in peat. Differences in the kinds of plant materials (type), in degree of metamorphism (rank), and in the range of impurity (grade) are characteristic of coal and are used in classification.

Colluvium—A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity. Talus and cliff debris are included in such deposits.

Completion—The activities and methods to prepare a well for production. Includes installation of equipment for production from an oil or gas well.

Conditions of Approval—Conditions or provisions (requirements) under which an Application for a Permit to Drill or a Sundry Notice is approved.

Connate Water—Water entrapped in the interstices of a sedimentary rock at the time the rock was deposited.

Conspecific—Of or pertaining to the same species.

Controlled Surface Use (CSU)—A fluid minerals leasing constraint under which use and occupancy is allowed (unless restricted by another stipulation), but identified resource values require special operational limitations that may modify lease rights.

Corridor—For purposes of this environmental assessment, a wide strip of land within which a proposed linear facility could be located.

Council on Environmental Quality (CEQ)—An advisory council to the President of the United States established by the national Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the president on environmental matters.

Cow-Calf Livestock Operation—A livestock operation in which a base breeding herd of mother cows and bulls is maintained. The cows produce a calf crop each year, and the operation keeps some heifer calves from each calf crop for breeding herd replacements. The operation sells the rest of the calf crop between the ages of 6 and 12 months along with old or non-productive cows and bulls.

Critical Habitat—An area occupied by a threatened or endangered species “on which are found those physical and biological features (1) essential to the conservation of the species, and (2) which may require special management considerations or protection” (16 USC 1532 (5)(A)(I)1988). Unoccupied by suitable habitat for the threatened or endangered species is not automatically included unless such areas are essential for the conservation of the species (50 CFR 424.12(e)0.

Crucial Habitat—An area that is essential to the survival of any wildlife species sometime during its life cycle.

Cultural Resource Inventory Classes:

Class I - Inventory of existing data: A study of a defined area designed (1) to provide a narrative overview (cultural resource overview) derived from existing cultural resource information and (2) to provide a compilation of existing cultural resource site record data on which to base the development of the BLM's site record system.

Class III - An intensive field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a specified area. A Class III inventory is appropriate on small project areas, all areas to be disturbed, and primary cultural resource areas.

Cultural Resources—Remains of human activity, occupation, or endeavor, as reflected in districts, sites, buildings, objects, artifacts, ruins, works of art, architecture, and natural features important in human events.

Cumulative Impact—The impact on the environment that results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cuttings—Fragments of rock dislodged by the bit and brought to the surface in the drilling mud.

Debitage (cultural resources)—Waste flakes from tool-making activities.

Depth of Burial—The depth below the ground surface and/or thickness of overlying stratum over a particular rock unit of geologic interest. Coals buried at a depth of more than 4,000 feet do not have the flow capacity needed for economic methane gas development.

Depth to Coal Pay—The depth below the ground surface of a potential economic coal unit.

Desiccation—The removal of moisture; to become dried up.

Decision Area—Public land (BLM-administered) and private split-estate (i.e., private surface acreage overlying Federally owned fluid minerals) are referred to in this document as BLM's Decision Area.

Development Well—A well drilled within the known or proven productive area of an oil field with the expectation of producing oil or gas from the producing reservoir.

Dewatering—The act of removing water.

Directional Drilling—The intentional deviation of a wellbore from vertical to reach subsurface areas off to one side from the drilling site.

Discretionary Closure—Those lands where the BLM has determined that fluid minerals leasing, even with the most restrictive stipulations, would not adequately protect other resources, values, or land uses.

Disposal Well—A well into which produced water from other wells is injected into an underground formation for disposal.

Distribution Line—An electric power line operating at a voltage of less than 69 kilovolts.

Diurnal—Describes a cyclic event recurring daily; or the nature or habit of an organism to be active during daylight hours.

Diversity—The relative abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area.

Drilling Fluids—The circulating fluid used to bring cuttings out of the wellbore, cool the drill bit, provide hole stability, and pressure control.

Drilling Rig—The derrick, draw-works, and attendant surface equipment of a drilling or workover unit.

Drilling—The operation of boring a hole in the earth, usually for the purpose of finding and removing subsurface formation fluids such as oil and gas.

Dry Hole—Any well incapable of producing oil or gas in commercial quantities. A dry hole may produce water, gas, or even oil, but not enough to justify production.

Easement—A right afforded a person or agency to make limited use of another's real property for access or other purposes.

Embargo—A restriction imposed on commerce by law; especially a prohibition of trade in a particular commodity.

Emission—Effluent discharge into the atmosphere, usually specified by mass per unit time.

Endangered Species—Any animal or plant species in danger of extinction throughout all or a significant portion of its range.

Enhanced Recovery—The use of artificial means to increase the amount of hydrocarbons that can be recovered from a reservoir. A reservoir depleted by normal extraction usually can be restored by secondary or tertiary methods of enhanced recovery.

Environmental Impact Statement (EIS)—A document prepared to analyze the impacts on the environment of a proposed action and released to the public for review and comment. An EIS must meet the requirements of NEPA, CEQ, and the directives of the agency responsible for the proposed action.

Erosion—The group of processes whereby earthy or rocky material is worn away by natural sources such as wind, water, or ice and removed from any part of the earth’s surface.

Ephemeral Stream—A stream that flows only in direct response to precipitation.

Evapotranspiration—Loss of water from a land area through transpiration of plants and evaporation from the soil.

Exploration Well—A well drilled in the area where there is no oil or gas production (also known as wildcat well).

Exsolve—From exsolution, the process whereby an initially homogeneous solid solution separates into two (or possibly more) distinct crystalline phases without addition or removal of material to or from the system; i.e., without change in the bulk composition. It generally, though not necessarily, occurs on cooling. Synonym: *unmixing*.

Eyrie—The nest of birds of prey.

Fan—An accumulation of debris brought down by a stream descending through a steep ravine and debouching in the plain beneath, where the detrital material spreads out in the shape of a fan, forming a section of a very low cone.

Federal Candidate Species—Sensitive wildlife species currently under consideration for inclusion to the list of Federal threatened or endangered species. Species are placed in one of the following categories:

1. Available data on biological vulnerability and threat(s) support listing, but additional data are needed on precise habitat and/or critical habitat boundaries.
2. Available data indicate that listing may be appropriate, but substantial data on vulnerability and threats are not available to support immediate listing.
- 3A. Probably extinct.
- 3B. Taxa do not meet the USFWS definition of species; taxa may be re-evaluated in the future.
- 3C. Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat; further research may indicate re-evaluation to Category 1 or 2.

Federal Land Policy and Management Act of 1976 (FLPMA)—Public Law 94-570 signed by the President of the United States on October 21, 1976. Established public land policy for management of lands administered by the Bureau of Land Management (BLM). FLPMA specifies several key directions for the BLM, notably (1) management on the basis of multiple use and sustained yield, (2) land plans prepared to guide management actions, (3) public land management for the protection, development, and enhancement of resources, (4) public land retention in Federal ownership, and (5) public participation in reaching management decisions.

Federal Listed Species—Animal or plant species listed by the USFWS as threatened or endangered.

Fiduciary—Held in trust.

Flare—An arrangement of piping and a burner to dispose of surplus combustible vapors, usually situated around a gasoline plant, refinery, or producing well.

Floodplain—The flat ground along a stream that is covered by water when the stream overflows its banks at flood stages.

Fluid Minerals—In this case, oil, gas, and geothermal resources.

Forage—All browse and herbaceous foods available to grazing animals, which may be grazed or harvested for feeding.

Foreground View—The landscape area visible to an observer within a mile.

Formation—A body of rock identified by lithic characteristics and stratigraphic position; it is prevailingly, but not necessarily tabular, and is mappable at the earth's surface or traceable in the subsurface (NACSN, 2984, Art. 24).

Fossil—Any remains, trace, or imprint of a plant or animal that has been preserved by natural processes in the earth's crust since some past geologic time.

Fractured—Fissured, broken, or cracked. See also Hydraulic Fracturing.

Fragile Soil—A soil that is especially vulnerable to erosion or deterioration due to its physical characteristics and/or location. Disturbance to the surface or the vegetative cover can initiate a rapid cycle of loss and destruction of soil material, structure, and ability to sustain a biotic community.

Fragmentation—See Habitat Fragmentation.

Free Market—An economic market operating by free competition.

Fugitive Dust—Airborne particles emitted from any source other than through a stack or vent.

Game Management Unit (GMU)—Colorado is divided into approximately 150 geographic areas called Game Management Units. Game species are managed on a unit specific basis.

Geophysics—Study of the earth by quantitative physical methods.

Graben—Fault block valley; elongated, depressed crustal block bounded by faults on its long side.

Habitat—A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

Habitat Fragmentation—The disruption (by division) of extensive habitats into smaller habitat patches. The effects of habitat fragmentation include loss of habitat area and the creation of smaller, more isolated patches of remaining habitat.

Habitat Management Plan (HMP)—A written and officially approved plan for a specific geographical area of public land that identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

Habitat Type—An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Herpetofauna—Reptiles and amphibians.

Highest and Best Use—Use of a resource (i.e., property) that maximizes its potential.

Historic—Archaeological and archivally known sites related to the activities of non-native peoples, whether they be of Euro-American, Afro-American or Asian-American origin, in the period after the European discovery of the New World (ca. A.D. 1492).

Hummocky—Like a hummock, full of hummocks (a low, rounded hill, knoll, hillock; a tract of wooded land higher than a nearby swamp or marsh).

Hydraulic Fracturing—A method of stimulating production by increasing the permeability of the producing formation.

Hydric Soils—Saturated soils.

Hydrocarbons—Organic compounds of hydrogen and carbon, whose densities, boiling points, and freezing points increase as their molecular weights increase. Although composed mostly of carbon and hydrogen, hydrocarbons exist in a great variety of compounds, owing to the strong affinity of the carbon atom for other atoms and itself. The smallest molecules are gaseous; the largest are solids. Petroleum is a mixture of many different hydrocarbons.

Hydrogeologically Connected—The connection of two or more hydrologic systems, usually refers to separate aquifers in which water can pass and exchange with other aquifers.

Hydrophytic—Water-loving; ability to grow in water or saturated soils.

Hydrostatic Test—The testing of pipeline integrity by closing of all openings and pumping water into the pipe at a pressure greater than the normal operating pressure to determine whether or not leaks are present.

Immigrant—Individual who moves into the project area from another part of the country.

Impact—A modification of the existing environment caused by an action (such as construction or operation of facilities).

Incised Channels—Deeply and sharply cut stream channels.

Increments—Maximum allowable increases over legally established baseline concentrations of pollutants covered by the Prevention of Significant Deterioration (PSD) provisions designated as Class I, II, and III areas.

Indian Mineral Estate—A mineral estate owned by the Federal government and held in trust for the Indian people. The Bureau of Indian Affairs and Bureau of Land Management, as agents of the Secretary of the Interior, have the responsibility for administering the leasing and development of oil and gas resources in such a case. However, under the auspices of the Indian Self Determination Act of 1968 and Indian Mineral Development Act of 1982, Indian people may take a leadership role in the management of their mineral resources.

Indicator Species—A species of animal or plant whose presence is a fairly certain indication of a particular set of environmental conditions. Indicator species serve to show the effects of development actions on the environment.

Indirect Impacts—Secondary effects that occur in locations other than the initial action or later in time.

Indurated—Said of a compact rock or soil hardened by the action of pressure, cementation, and especially heat. Also, said of an impure, hard, slately variety of talc.

Infrastructure—The facilities, services, and equipment needed for a community to function including roads, sewers, water lines, police and fire protection, and schools.

Injection—The forcing, under abnormal pressure, of material (downward from above, upward from below, or laterally) into a pre-existing deposit or rock, either along some plane or weakness or into a pre-existing crack or fissure.

Injection Well—A well used to inject fluids into an underground formation to increase reservoir pressure.

Insignificant or Nonsignificant Impacts—Impacts that are perceptible or measurable relative to those occurring naturally or due to other actions, and would not exceed significance criteria.

Intermittent Stream—A stream or reach of a stream that is below the local water table for at least some part of the year.

Joint Patterns—Patterns of fractures in rock, generally vertical or transverse to bedding, along which no appreciable movement has occurred.

Jurisdiction—The legal right to control or regulate use of a transportation facility. Jurisdiction requires authority, but not necessarily ownership.

K-factor—Soil erodibility factor.

Lacustrine—Of or pertaining to a lake.

Landscape—An area composed of interacting ecosystems that are repeated because of geology, landform, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern which is determined by interacting ecosystems.

Landscape Character—Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting—The context and environment in which a landscape is set; a landscape backdrop.

Leasable Minerals—Those minerals or materials designated as leasable under the Mineral Leasing Act of 1920. They include coal, phosphate, asphalt, sulphur, potassium, and sodium minerals, and oil, gas, and geothermal.

Lease—(1) A legal document that conveys to an operator the right to drill for oil and gas; (2) the tract of land, on which a lease has been obtained, where producing wells and production equipment are located.

Lease Notice—Provides more detailed information concerning limitations that already exist in law, lease terms, regulations, and operational orders. A Lease Notice also addresses special items the lessee would consider when planning operations, but does not impose new or additional restrictions.

Lease Stipulation—A modification of the terms and conditions on a standard lease form at the time of the lease sale.

Lenticular—Shaped approximately like a double convex lens.

Level of Service (LOS)—In transportation studies, a qualitative measure of traffic flow along a given road considering a variety of factors, including speed and travel time, traffic interruptions and freedom to maneuver. Levels of service are designated “A” through “F”; “A” being a free-flow condition with low volumes at high speeds and “F” being a congested condition of low speeds and stop-and-go traffic. Intermediate levels describe conditions between these extremes. A level of service below “C” involves unstable to forced traffic flow in which a driver's freedom to select a speed is restricted and in which traffic stoppages cause congestion.

Liquefaction—A change in the phase of a substance to the liquid state; usually a change from the gaseous to the liquid state, especially of a substance that is a gas at normal pressure and temperature.

Lithic Scatter—A scatter of chipped stone materials, which may include fragments, flakes, or stone tools.

Lithology—The physical characteristics of a rock, generally as determined megascopically or with the aid of a low-power magnifier.

Logging Tool—Electric tools that are able to be lowered down a well bore by wire cable and are capable of taking measurements of the physical properties of the rock formations downhole (i.e., resistivity, self-potential, gamma-ray, intensity, or velocity). The data is recorded and displayed on well logs that aid in defining physical rock characteristics such as lithology, porosity, pore geometry, and permeability.

Management Indicator Species—Those species that are commonly hunted or whose habitat requirements and population changes are believed to indicate effects of management activities on a broader group of wildlife species in the ecological community.

Management Situation Analysis—Assessment of the current management direction. It includes a consolidation of existing data needed to analyze and resolve identified issues, a description of current BLM management guidance, and a discussion of existing problems and opportunities for solving them.

Middleground View—One of the distance zones of a landscape being viewed. This zone extends from the limit of the foreground to three to five miles from the observer.

Migration (oil and gas)—the movement of liquid and gaseous hydrocarbons from their source or generating beds, through permeable formations into reservoir rocks.

Mineral Estate (Mineral Rights) – The ownership of minerals, including rights necessary for access, exploration, development, mining, ore dressing, and transportation operations.

Mineral Reserves—Known mineral deposits that are recoverable under present conditions but are as yet undeveloped.

Mineral Rights—Mineral rights outstanding are third-party rights, an interest in minerals not owned by the person or party conveying the land to the United States. It is an exception in a deed that is the result of prior conveyance separating title of certain minerals from the surface estate.

Reserved mineral rights are the retention of ownership of all or part of the mineral rights by a person or party conveying land to the United States. Conditions for the exercising of these rights have been defined in the Secretary of the Interior’s “Rules and Regulations to Govern Exercising of Mineral Rights Reserved Conveyance to the United States” attached to and made a part of deeds reserving mineral rights.

Mitigation—The abatement or reduction of an impact on the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, or (5) replacing or providing substitute resources to the environment or (6) gathering archaeological and paleontological data before disturbance.

Modification—A fundamental change in the provisions of a lease stipulation, either temporarily or for the term of the lease. A modification may, therefore, include an exemption from or alteration to a stipulated requirement. Depending on the specific modification, the stipulation may or may not apply to all other sites within the leasehold to which restrictive stipulation applies.

Multiple Use—Multiple use as defined by the Multiple Use—Sustained Yield Act 1960 means the management of all the various renewable surface resources so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be

used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

National Ambient Air Quality Standards (NAAQS)—The allowable concentrations of air pollutants in the air specified by the Federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare) from any unknown or expected adverse effects of air pollutants.

National Environmental Policy Act of 1969 (NEPA)—An Act that encourages productive and enjoyable harmony between man and his environment and promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation, and establishes the Council on Environmental Quality.

National Natural Landmarks—Sites designated by the Secretary of the Interior as containing the best representative examples of geologic features and natural communities composing the nation's natural history. The purpose of the designation is to encourage preservation of such sites through well-informed management and use, and consideration of these sites in public and private land use planning. Designation has no legal effect on land ownership, use, or management (National Park Service, not date, National Natural Landmark Designation).

National Register of Historic Places (National Register, NRHP)—A listing of architectural, historical, archaeological, and cultural sites of local, state, or national significance. The list of sites was established by the Historic Preservation Act of 1966 and is maintained by the National Park Service.

Negligible Impact—Impact that is small in magnitude and importance and are difficult or impossible to quantify relative to those occurring naturally or due to other actions.

Nondiscretionary Closure—Those lands that must be closed to leasing for reasons beyond the discretion of the BLM. These are lands specially precluded from fluid minerals leasing by law, regulations, Secretarial or Executive Order, or that otherwise have been closed formally by decisions reached beyond the scope of the BLM.

No Surface Disturbance—In general, this applies to an area where an activity is allowed so long as it does not disturb the surface.

No Surface Occupancy (NSO)—A fluid minerals leasing constraint that prohibits occupancy or disturbance on all or part of the lease surface to protect special values or uses. Lessees may exploit the fluid mineral resources under the leases restricted by this constraint through use of directional drilling from sites outside the NSO area.

Non-Range—Areas that are not suitable for livestock grazing due to low forage production, steep slopes, dense brush, or other reasons.

Notice of Review Species—A species that is being considered as a candidate for listing as either endangered or threatened under the Endangered Species Act of 1973, as amended.

Notice to Lessees (NTL)—A written notice issued by the BLM to implement regulations and operating orders, and serve as instructions on a specific item(s) of importance within a state, district, or area.

Noxious Weed—An undesirable weed species that can crowd out more desirable species.

Off-Highway Vehicle (OHV)—A vehicle (including four-wheel drive, trail bikes, all-terrain vehicles, and snowmobiles but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling off road over land, water, ice, snow, sand, marshes, and other terrain.

Off-Road Vehicle (ORV) Designations

Closed – Applies to areas and trails where the use of ORVs is permanently or temporarily prohibited. Emergency use of vehicles is allowed.

Limited – Applies to areas and trails where the use of ORVs is subject to restrictions such as limiting the number or types of vehicles allowed, dates and times of use (seasonal restrictions), limiting use to existing roads and trails, or limiting use to designated roads or trails. Under the designated roads and trails designation, use is allowed only on roads and trails that are signed for use. Combinations of restrictions, such as limiting use to certain types of vehicles during certain times of the year, are possible.

Open – Applies to areas and trails where ORVs may be operated subject to operating regulations and vehicle standards set forth in BLM Manuals 8341 and 8343.

One-Hundred-Year Flood—A hydrologic event with a magnitude that has a recurrence interval of 100 years.

Operating Rights (working interest)—Any interest held in a lease with the right to explore for, develop, and produce leased substances.

Operator—Any person who has taken formal responsibility for the operations conducted on the leased lands.

Paleontology—A science dealing with the life of past geological periods as known from fossil remains.

Palustrine—A system of wetlands that includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.

Particulate Matter (PM₁₀)—Particulate matter less than 10 microns in effective diameter (also called Fine Particulate Matter).

Patent—A grant made to an individual or group conveying fee simple title to public lands.

Peidmont—Lying or formed at the base of mountains.

Perennial Stream—A stream receiving water from both surfaces and underground sources that flows throughout the entire year.

Perforations—Holes that are made through the casing and cement, and extend some distance into the production zone.

pH—A numeric value that gives the relative acidity or alkalinity of a substance on a 0 to 14 scale with the neutral point at 7. Values lower than 7 show the presence of acids, and values greater than 7 show the presence of alkalis.

Physiognomic Physiographic Province—A region all parts of which are similar in geologic structure and climate and which has consequently had a unified geomorphic history; a region whose pattern of relief features or landforms differs significantly from that of adjacent regions.

Plan of Development—A mandatory plan, developed by an applicant of a mining operation or construction project, that specifies the techniques and measures to be used during construction and operation of all project facilities on public land. The plan is submitted for approval to the appropriate Federal agency before any construction begins.

Planning Area—A geographical area for which land use and resource management plans are developed and maintained.

Plug—Any object or device that serves to block a hole or passageway, as a cement plug in a borehole.

Prehistoric—Archaeological sites resulting from the activities of aboriginal peoples native to this region, and because dating is often difficult, extending up to the reservation era (ca. A.D. 1868).

Prevention of Significant Deterioration (PSD)—A regulatory program based not on the absolute levels of pollution allowable in the atmosphere but on the amount by which a legally defined baseline condition will be allowed to deteriorate in a given area. Under this program, geographic areas are divided into three classes, each allowing different increases in nitrogen dioxide, particulate matter, and sulfur dioxide concentrations.

Primary Range—Areas where the majority of livestock grazing is concentrated, due to high forage production, easy accessibility, nearby water sources, or other reasons.

Prime Farmland—Land that is best suited for producing food, feed, forage, fiber, and oilseed crops. The inventory of prime agricultural land is maintained by the USDA Natural Resources Conservation Service, (formerly the Soil Conservation Service).

Primitive—Refers to areas that are almost completely free of management controls, are located more than three miles from the nearest point of motor vehicle access, and have unmodified landscapes and little evidence of other people.

Production Well—A well drilled in a known field that produces oil or gas.

Proposed Action—Construction activities, alignments, and other activities proposed by the applicant.

Proppants—Sandgrains, aluminum pellets, glass beads, or similar materials used in hydraulic fracturing. When injected into the production formation, these materials leave channels allowing gas to flow through them into the well.

Public Land—Any land and interest in land (outside Alaska) owned by the United States and administered by the Secretary of the Interior through the BLM.

Quaternary—The younger of the two geologic periods or systems in the Cenozoic Era.

Rangeland—Land used for grazing by livestock and big game animals on which vegetation is dominated by grasses, grass-like plants, forbs, or shrubs.

Raptor—Bird of prey with sharp talons and strongly curved beak; e.g., hawk, owl, vulture, eagle.

Rare or Sensitive Species—Species that have no specific legal protection under the Endangered Species Act as threatened or endangered species, but are of special concern to agencies and the professional biologic community due to low populations, limited distributions, ongoing population decline, and/or human or natural threats to their continued existence.

Reasonable Foreseeable Development Scenario—The prediction of the type and amount of oil and gas activity that would occur in a given area. The prediction is based on geologic factors, past history of drilling, projected demand for oil and gas, and industry interest.

Reciprocation—A technique performed while cementing, whereby casing is moved up and down the wellbore in order to move the cement slurry uniformly around the wellbore to eliminate channeling and provide an effective cement bond on the casing and formation walls.

Reclamation—The process of converting disturbed land to its former use or other productive uses.

Recreation and Public Purposes Act (R&PP)—This act authorizes the Secretary of the Interior to lease or convey public lands for recreational and public purposes, under specified conditions, to states or their political subdivisions and to nonprofit corporations and associations.

Resource Management Plan (RMP)—A land use plan that establishes land use allocations, multiple-use guidelines, and management objectives for a given planning area. The RMP planning system has been used by the BLM since 1980.

Record of Decision—A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action.

Reserve Pit—(1) Usually an excavated pit that may be lined with plastic that holds drill cuttings and waste mud. (2) Term for the pit that holds the drilling mud.

Reservoir (oil and gas)—A naturally occurring, underground container of oil and gas, usually formed by deformation of strata and changes in porosity.

Rift—A system of fractures (faults) in the earth's crust and the associated valley or depression.

Riparian—Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow along, around, or in wet areas.

Riverine—A system of wetlands that includes all wetland and deep-water habitats contained within a channel that lacks trees, shrubs, persistent emergents, and emergent mosses or lichens.

Roadless—Refers to the absence of roads constructed and maintained by mechanical means.

Roads—Vehicle routes that are improved and maintained by mechanical means to ensure relatively regular and continuous use. (A way maintained strictly by the passage of vehicles does not constitute a road.)

Rotation—A technique performed while cementing, whereby casing is rotated in the hole in order to move the cement slurry uniformly around the casing to eliminate channeling and provide an effective cement bond on the casing and formation walls.

Salinity—A measure of the amount of dissolved salts in water.

San Juan Basin—A large geologic basin located in northwestern New Mexico and southwestern Colorado that has been extensively drilled for oil and gas and is reportedly the second largest gas-producing basin in the continental United States. (A summary of the mineral development history is provided in Chapter 1.)

Saline water—Water containing high concentrations of salt (see also brine).

Scoping—A term used to identify the process for determining the scope of issues related to a proposed action and for identifying significant issues to be addressed in an EIS.

Scraper Trap—A device on the pipeline used to receive a scraper pig or inside pipe inspection pig.

Scratchers—A device fastened to the outside of the casing that removes drilling mud from the wall of the hole to condition the hole for cementing. By rotating or moving the casing up and down as it is being inserted into the hole, the scratcher, formed of stiff wire, removes drilling mud so that cement can bond solidly to the formation wall.

Screened—The depth at which a well screen has been placed on a well. A well screen allows fluids to enter the well casing.

Secondary Range—Areas where livestock grazing occurs but at lower intensities than primary range, due to less favorable conditions of forage production, terrain, distance from water source, or other factors.

Secondary Succession—The process by which ecosystems recover toward pre-existing conditions after removal of a disturbance, such as the recovery process of a forest after a fire.

Sediment—Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water, or on land.

Sediment Yield—The amount of sediment produced in a watershed, expressed in tons, acre feet, or cubic yards, of sediment per unit of drainage area per year.

Sedimentary Rock—Rock resulting from consolidation of loose sediment that has accumulated in layers.

Selenium—A chemical element of the sulfur group.

Semiprimitive—Refers to areas that have very few management controls, are located between 0.5 mile (800 meters) and 3 miles from the nearest point of motor vehicle access (excluding four-wheel drive roads and trails), and have mostly natural landscapes and some evidence of other people.

Sensitive Plant Species—Those plant or animal species susceptible or vulnerable to activity impacts or habitat alterations.

Sensitivity Levels (visual resources)—A measure of people's concern for scenic quality.

Shut-in—An oil and gas well that is capable of production but is temporarily not producing.

Significant—An effect that is analyzed in the context of the proposed action to determine the degree or magnitude of importance of the effect, either beneficial or adverse. The degree of significance can be related to other actions with individually insignificant but cumulatively significant impacts.

Significance Criteria—Criteria identified for specific resources used to determine whether or not impacts would be significant.

Slope—The degree of deviation of a surface from the horizontal.

Slug Tests—A test used to calculate hydraulic conductivity, transmissivity, and the storage coefficient (i.e. the wells potential yield).

Soil Horizon—A distinct layer of soil, approximately parallel to the land surface, and different from adjacent, genetically related layers in physical, chemical, and biological properties or characteristics.

Soil Productivity—The capacity of a soil to produce a plant or sequence of plants under a system of management.

Soil Series—A group of soils having genetic horizons (layers) that, except for texture of the surface layer, have similar characteristics and arrangement in profile.

Soil Texture—The relative proportions of sand, silt, and clay particles in a mass of soil. Basic textural classes, in order of increasing proportions of fine particles, are: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, and clay.

Split Estate—Refers to land where the mineral rights and the surface rights are owned by different parties. Owners of the mineral rights generally have a superior right.

Standard Lease Terms and Conditions—Areas may be open to leasing with no specific management decisions defined in a Resource Management Plan; however, these areas are subject to lease terms and conditions as defined on the lease form (Form 3100-11, Offer to Lease and Lease for Oil and Gas; and Form 3200-24, Offer to Lease and Lease for Geothermal Resources).

Stipulations—Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to the lease at the discretion of the surface management agency to protect valuable surface resources and uses.

Storage Coefficient—The volume of water released from storage in a vertical column of 1 square foot when the water table or other piezometric surface declines 1 foot.

Stratigraphy—The arrangement of strata, especially as to geographic position and chronologic order of sequence.

Structural Trap—One in which entrapment results from folding, faulting, or a combination of both.

Suitability—As used in the Wilderness Act and the Federal Land Policy and Management Act, refers to a recommendation by the Secretary of the Interior or the Secretary of Agriculture that certain Federal lands satisfy the definition of wilderness in the Wilderness Act. These lands have been found appropriate for designation as wilderness on the basis of an analysis of their existing and potential uses.

Sundry Notice—Standard form to notify of or propose change of approved well operations subsequent to an Application for Permit to Drill in accordance with 43 CFR 3162.3-2 .

Surface Management Agency—Any agency, other than the BLM, with jurisdiction over the surface overlying Federal minerals.

Sustainability—The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

Sustained Yield—The achievement and maintenance, in perpetuity, of a high-level annual or regular periodic output of the various renewable resources on public lands consistent with multiple use.

Syncline—A fold of stratified rock inclining upward in opposite directions from both sides of its axis (opposed to anticline).

Tertiary—The older of the two geologic periods comprising the Cenozoic Era; also the system of strata deposited during that period.

Thermogenic—Of or pertaining to the rise in temperature in a body from reactions in that body, as by oxidation, or the decay of radioactive elements.

Threatened or Endangered Species—Animal or plant species that are listed under the Federal Endangered Species Act of 1973, as amended (federally listed), or under the Colorado or New Mexico Endangered Species Act (state listed).

Threatened Species—Any plant or animal species likely to become endangered within the foreseeable future throughout all or part of its range.

Thrust Fault—A reverse fault that is characterized by a low angle of inclination with reference to a horizontal plane.

Timing Limitation (Seasonal Restriction)—A fluid minerals leasing constraint that prohibits surface use during specified time periods to protect identified resource values. The constraint does not apply to the operation and maintenance of production facilities unless analysis demonstrates that such constraints are needed and that less stringent, project-specific constraints would be insufficient.

Toe-slope—The most distant part of a landslide; the downslope edge of a landslide or slump.

Total Dissolved Solids—A term that describes the quantity of dissolved material in a sample of material.

Total Suspended Particulates (TSP)—All particulate matter, typically less than 70 microns in effective diameter.

Total Suspended Solids—A term that describes the quantity of solid material in a sample of material.

Transmissivity—The rate at which water is transmitted through a unit width of aquifer under a hydraulic gradient.

Trap—A body of reservoir rock completely surrounded by impervious rock; a closed reservoir.

Turbolator—A type of centralizer that induces turbulent flow for better drilling mud displacement and cement sheath placement.

Unionized Ammonia—A species of nitrogen that is toxic to aquatic life.

Utilization (rangeland)—The proportion of the current year's forage production that is consumed or destroyed by grazing animals. Utilization is usually expressed as a percentage.

Vadose Zone—Zone of aeration.

Valid Existing Rights—Legal interests that attach a land or mineral estate and cannot be divested from the estate until those interests expire or are relinquished.

Vandalism—Willful or malicious destruction or defacement of public property; e.g., cultural or paleontological resources.

Vegetation Manipulation—Planned alteration of vegetation communities through use of prescribed fire, plowing, herbicide spraying, or other means to gain desired changes in forage availability or wildlife cover.

Vegetation Type—A plant community with distinguishable characteristics described by the dominant vegetation present.

Vent—An opening in a vessel, line, or pump to permit the escape of air or gas.

Visual Resources—the visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.

Visual Resource Management (VRM)—The inventory and planning actions taken to identify visual resource values and to establish objectives for managing those values. Also, management actions taken to achieve the established objectives.

Visual Resource Management Classes—VRM classes identify the degree of acceptable visual change within a particular landscape. A classification is assigned to public lands based on guidelines established for scenic quality, visual sensitivity, and visibility.

VRM Class I – This classification preserves the existing characteristic landscape and allows for natural ecological changes only. Includes Congressionally authorized areas (wilderness) and areas approved through an RMP where landscape modification activities should be restricted.

VRM Class II – This classification retains the existing characteristic landscape. The level of change in any of the basic landscape elements (form, line, color, texture) due to management activities should be low and not evident.

VRM Class III – This classification partially retains the existing characteristic landscape. The level of change in any of the basic landscape elements due to management activities may be moderate and evident.

VRM Class IV – this classification applies to areas where the characteristic landscape has been so disturbed that rehabilitation is needed. Generally considered an interim short-term classification until rehabilitation or enhancement is completed.

Visual Sensitivity—Visual sensitivity levels are a measure of public concern for scenic quality and existing or proposed visual change.

Vugo—(Petrology) A small cavity in a vein or in rock, usually lined with crystals of a different mineral composition from the enclosing rock. (Oil) A term used in petroleum geology for an opening in a rock, from the size of a small pea upwards.

Waiver—Permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

Water Table—The surface in a groundwater body where the water pressure is atmospheric. It is the level at which water stands in a well that penetrates the water body just far enough to hold standing water.

Wetland—Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. BLM Manual 1737, *Riparian-Wetland Area Management*, includes marshes, shallow swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, and riparian areas as wetlands.

Wilderness, Wilderness Area—An area formally designated by Congress as a part of the National Wilderness preservation System.

Wilderness Characteristics—Qualities identified by Congress in the Wilderness Act of 1964 including size; naturalness; outstanding opportunities for solitude or a primitive and unconfined type of recreation; and supplemental values such as geological, archaeological, historical, ecological, scenic, or other features.

Wilderness Management Policy—The policy that describes the general objectives, policies, and specific activity guidance applicable to all designated BLM wilderness areas. Specific management objectives, requirements, and decisions that implement administrative practices and visitor activities in individual wilderness areas are developed and described in a wilderness management plan for each unit.

Wilderness Study Area (WSA)—An area determined to have wilderness characteristics as described in section 603 of the Federal Land Policy and Management Act and Section 2C of the Wilderness Act of 1964 (78 Stat. 891). WSAs are subject to interdisciplinary analysis through the BLM’s land use planning system and public comment to determine their wilderness suitability. Suitable areas are recommended to the President and Congress for designation as wilderness.

Withdrawal—An action that restricts the use of public land and segregates it from the operation of some or all of the public land and mineral law. Withdrawals also are used to transfer jurisdiction of management of public lands to other Federal agencies.

Work Force—The total number of workers on a specific project or group of projects. The work force also is referred to as direct employment and primary employment.

REFERENCES

- American Geological Institute. 1999. Geologic Time Scale.
- Anderholm, S.K., M.J. Radell and S.F. Richey. 1995. Water Quality Assessment of the Rio Grande Valley Study Unit, Colorado, New Mexico, and Texas, Analysis of Selected Nutrient, Suspected-Sediment, and Pesticide Data. *U.S. Geological Survey Water Resources Investigations Report 94-4061*.
- Anderson, O.J., G.E. Jones and G.N. Green. 1997. Geologic Map of New Mexico. *U.S. Geological Survey Open File Report OF 97-52*.
- Barker, J.M., Robert Bolton and K. Birdsall. 1988. Sand and Gravel Producers in New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Resource Map 17*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Barker, J.M., F. Campbell, R.W. Eveleth, V.T. McLemore and G.H. Roybal. 1984. Active Mines and Processing Plants by County in New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Resource Map 14*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Black, B.A. 1975. Geology and oil and gas potential of the northeast Otero platform area, New Mexico. In Las Cruces Country, New Mexico. *New Mexico Geological Society Guidebook No. 26*. Edited by W.R. Seager, R.E. Clemons, and J.F. Callender.
- Bogan, M. 1999. Personal communication with M. Bogan, New Mexico Department of Fish and Game. March 18.
- Brady, B.T., M.S. Bedinger and D.L. Hart. 1984. Maps Showing Ground-water Units and Withdrawal, Basin and Range Province New Mexico. *U.S. Geological Survey Water Resources Investigations Report 83-4118-A*.
- Brookins D.C., J.F. Callender, W.E. Elston, G.P. Landis, G.R. Jiracek, A.M. Kudo, L.A. Woodward and C.A. Swanberg. 1981. Evaluation of Geothermal Potential of Rio Grande Rift and Basin and Range Province, New Mexico.
- BRW, Inc. 1998. Transportation Analysis completed for the Preliminary Draft Environmental Impact Statement for Oil and Gas Leasing and Development on the Southern Ute Indian Reservation.

- Bulter, W.C. 1988. The Rationale for Assessment of Undiscovered, Economically-Recoverable Oil and Gas in South-Central New Mexico: A Geologic Overview and Play Analysis of Two Favorable Areas. *U.S. Geological Survey Open File Report 88-450-B*.
- Bureau of Business and Economic Research (BBER), University of New Mexico. 1996 and 1997. Information downloaded 2/12/99 from www.unm.edu/~bber.
- Callender, J.F., W.R. Seager and C.A. Swanberg. 1983. Late Tertiary and Quaternary Tectonics and Volcanism. *Geothermal Resources of New Mexico: Scientific Map Series*, New Mexico State University Energy Institute.
- County of Otero, New Mexico. 1998. *Otero County Comprehensive Plan-Goals*. May.
- Cox, E.R. and H.O. Reeder. 1962. Groundwater Conditions in the Rio Grande Valley between Truth or Consequences and Las Palomas, Sierra County, New Mexico. *New Mexico Office of the State Engineer Technical Report 25*.
- Davie, William Jr. and Zane Spiegel. 1967. *Las Animas Creek Hydrographic Survey Report, Geology and Water Resources of Las Animas Creek and Vicinity, Sierra County, New Mexico*. New Mexico Office of the State Engineer. Santa Fe, New Mexico.
- Deubel, Richard. 1999. Personal communication. Water Rights Division of the New Mexico State Engineer's Office.
- Dick-Peddie, William. 1993. *New Mexico Vegetation: Past, Present, and Future*. University of New Mexico Press, Albuquerque, New Mexico.
- _____. 1986. Typical vegetation of central New Mexico. *New Mexico Geological Society Guidebook, 37th Field Conference, Truth or Consequences, New Mexico*.
- _____. 1975. Vegetation of Southern New Mexico. *New Mexico Geological Society Guidebook, 26th Field Conference, Las Cruces Country*.
- Dunmire, W. 1992. Evaluation of existing and potential areas of critical environmental concern in the Caballo Resource Area, Bureau of Land Management. The Nature Conservancy. Santa Fe, New Mexico.
- Energy Information Administration (EIA). 1998. Table B22-Completed Well Costs, Oil, Gas, and Dry, Onshore and Offshore, for FRS Companies, 1996 and 1997. Form EIA-28 (Financial Reporting System). Department of Energy Website [<http://www.eia.foe.gov/emeu/perfpro/>].

- Ellis, S.R. 1991. National Water-Quality Assessment Program - The Rio Grande Valley. *U.S. Geological Survey Water Fact Sheet, Open File Report 91-160*.
- Federal Transit Administration. 1995. Transit Noise and Vibration Assessment.
- Fenneman, Nevin N. 1931. *Physiography of the Western United States*. New York: McGraw-Hill Book Company.
- Foster, R.W. 1978. Oil and Gas Evaluation of White Sands Missile Range and Fort Bliss Military Reservation, South-Central New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Open File Report 92*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Foster, R.W. and P.R. Grant. 1974. The Future of New Mexico's Oil and Gas Resources. *New Mexico State Bureau of Mines and Mineral Resources, Resource Map 3*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Garza, Sergio and J.S. McLean. 1971. *Freshwater Resources of the East Side of the Tularosa Basin, New Mexico*. U.S. Geological Survey. July.
- General Radio. 1972. *Handbook of Noise Measurement*.
- Geo-Heat. 1998. *Geothermal Direct-Use Engineering and Design Guidebook*, 3rd Edition. Geo-Heat Center, Oregon Institute of Technology.
- Grant, P.R., Jr. and R.W. Foster. 1989. *Future petroleum provinces in New Mexico -- Discovering New Reserves*. Prepared for the New Mexico Research and Development Institute by the New Mexico Bureau of Mines and Mineral Resources.
- Griffen, William B. 1983. Southern Periphery: East. In *Handbook of North American Indians, Volume 10: Southwest*, edited by Alfonso Ortiz, William C. Sturtevant, general editor, pp. 329-342. Smithsonian Institution, Washington, DC.
- Hanley, T. 1999. Personal communication. Las Cruces Field Office, Bureau of Land Management.
- Harley, G.T. 1934. The Geology and Ore Deposits of Sierra County, New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Bulletin 10*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.

- Harris, Arthur. 1993. Quaternary Vertebrates of New Mexico. In *Vertebrate Paleontology in New Mexico, New Mexico Museum of Natural History and Science Bulletin 2*.
- Harris, Cyril M. 1991. *Handbook of Acoustical Measurement and Noise Control*.
- Harris, L.D. and P.B. Gallagher. 1988. New Initiatives for Wildlife Conservation: The Need for Movement Corridors. *Florida Agricultural Experiment Station Journal Series No. 9668*. Gainesville, FL. Pp 11-34.
- Hatton K.S. 1978. Geothermal Energy. In *New Mexico's Energy Resources '77 - Office of the State Geologist. New Mexico Bureau of Mines and Mineral Resources, Circular 167*, E.C. Arnold, compiler. New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Healy, Dennis F. 1997. Water Quality Assessment of the Rio Grande Valley Study Unit, Colorado, New Mexico, and Texas – Summary and Analysis of Water-Quality Data for the Basic-Fixed-Site Network, 1993-95. *U.S. Geological Survey WRI Report 97-4212*.
- Helzer, C.J. and D.E. Jelinski. 1999. The relative importance of patch area and perimeter-area ratio to grassland breeding birds. *Ecological Applications* 9:448-458.
- Herkert, J.R. 1994. The effects of habitat fragmentation on midwestern grassland bird communities. *Ecological Applications* 3:461-471.
- Herrick, E.H. and L.V. Davis. 1965. Availability of Ground Water in the Tularosa Basin and Adjoining Areas, New Mexico and Texas. U.S. Geological Survey.
- Hood, James W. 1960. Availability of Groundwater in the Vicinity of Cloudcroft, Otero County, New Mexico. U.S. Geological Survey. October.
- Howard, M. 1999. Personal communication. Las Cruces Field Office, Bureau of Land Management.
- Hubbard, J. 1987. The status of the willow flycatcher in New Mexico. New Mexico Department of Game and Fish, Endangered Species Program.
- Hubbard, J. and C. Schmitt. 1983. *The black-footed ferret in New Mexico*. Final report to the BLM, Santa Fe, New Mexico. Contract No. NM-910-CTI-7. Prepared by the New Mexico Department of Fish and Game.

- Hunt, Adrian and Spencer Lucas. 1993a. Triassic Vertebrate Paleontology and Biochronology of New Mexico. In *Vertebrate Paleontology in New Mexico, New Mexico Museum of Natural History and Science Bulletin 2*.
- _____. 1993b. Jurassic Vertebrates of New Mexico. In *Vertebrate Paleontology in New Mexico, New Mexico Museum of Natural History and Science Bulletin 2*.
- _____. 1993c. Cretaceous Vertebrates of New Mexico. In *Vertebrate Paleontology in New Mexico, New Mexico Museum of Natural History and Science Bulletin 2*.
- Hutchins, M.F. 1983. Mineral Resource Areas of the Basin and Range Province of New Mexico. *U.S. Geological Survey Open-file Report 83-665*.
- Johnson, Terrel. 1994. Peregrine Falcon Habitat Management in National Forests of New Mexico. U.S. Forest Service.
- King, W.E. and V.M. Harder. 1986. Tularosa basin-Otero platform-Salt basin graben area potential - New Mexico, Texas. *The Oil and Gas Journal*, Volume 84, Number 43, Pages 97, 99-102, October 27.
- _____. 1985. Oil and Gas Potential of the Tularosa Basin-Otero Platform-Salt Basin Graben Area, New Mexico and Texas. *New Mexico Bureau of Mines and Resources, Circular 198*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Kirkpatrick, David T. and Meliha S. Duran. 1998. Prehistoric Peoples of the Northern Chihuahuan Desert. In *Las Cruces Country II, Guidebook, 49th Annual Field Conference*, edited by Greg H. Mack, George S. Austin and James M. Barker, pp. 41-45. New Mexico Geological Society, Albuquerque.
- Kottlowski. 1977. New Mexico Geology and Petroleum Potential. In *Interstate Oil Compact Commission Committee Bulletin*, Volume 19, Dec., Number 2.
- Kues, Barry. 1993. "Bibliographic Catalogue of New Mexico Vertebrate Fossils," in *Vertebrate Paleontology in New Mexico, New Mexico Museum of Natural History and Science, Bulletin 2*.
- Leach, M.K. and T.J. Givnish. 1996. Ecological determinants of species loss in remnant prairies. *Science* 273:1555-1558.

- LeBlanc, Steven A. and Michael E. Whalen. 1980. *An Archeological Synthesis of South-Central and Southwestern New Mexico*. Office of Contract Archaeology, University of New Mexico, Albuquerque.
- Lekson, Stephen H. 1992. *Archaeological Overview of Southwestern New Mexico* (final draft). Human Systems Research, Las Cruces.
- _____. 1984. An Archaeological Reconnaissance of the Rio Grande Valley in Sierra County. New Mexico. *Artifact* 27(2):1-102.
- Massey, Michael. 1999. Personal Communication. New Mexico Department of Game and Fish. March 17, 1999.
- McLean. 1975. *Saline Groundwater in the Tularosa Basin, New Mexico*. U.S. Geological Survey. Albuquerque, New Mexico.
- Mescalero Apache Indian Tribal Office. 1993. Mescalero Apache Tribe Demographic Characteristics.
- Metcalf, A. and R.A. Smartt. 1988. Annotated Checklist of New Mexico Land Snails. Final Report Contract 516.6-75-05. New Mexico Department of Game and Fish.
- Muffler L.J.P. 1979. Summary. In Assessment of Geothermal Resources of the United States, edited by L.J.P. Muffler. *U.S. Geological Survey Circular* 790.
- The Nature Conservancy. 1992. *Evaluation of Existing and Potential Areas of Critical Environmental Concern in the Caballo Resource Area*. March.
- Neilsen, R.P., 1986. High Resolution Climatic Analysis of Southwest Biography. *Science* 232:27-34.
- Nevada Department of Wildlife (NDOW). 1989. Monitoring the effects of military air operations at the Fallon Naval Air Station on the biota of Nevada. Rory E. Lamp.
- New Mexico Air Pollution Control Board. 1998. *Dispersion Modeling Guidelines*. Revised June 1998.
- New Mexico Department of Agriculture (NMDA). 1996a. *Agricultural Statistics*. Downloaded 2/16/99 from <http://nmdaweb.nmsu.edu>.

_____. 1996b. *County Facts*. Downloaded 1/27/99 from <http://nmda.nmsu.edu/MD/Counties%2096>.

New Mexico Department of Game and Fish (NMDGF). 1999a. *Biota Information System of New Mexico* (BISON-M).

_____. 1999b. *New Mexico Wildlife of Concern*.

_____. 1995. *New Mexico's Long-Range Plan for Desert Bighorn Sheep Management, 1995-2000*.

New Mexico Environment Department (NMED). 1998. Questions & Answers About TMDLs. 1998-2000 *State of New Mexico §303(d) List for Assessed River/Stream Reaches Requiring Total Maximum Daily Loads (TMDLs)*. Record of Decision for River/Stream Listings.

_____. 1996. *1996-1998 State of New Mexico §303(d) List for Assessed River/Stream Reaches Requiring Total Maximum Daily Loads (TMDLs)*. Record of Decision for River/Stream Listings. Surface Water Quality Bureau.

_____. 1994. *Ambient Air Quality Standards and Air Quality Control Regulations*, as revised. November 17.

New Mexico Office of the State Engineer (SEO). 1995. *Rules and Regulations Governing Drilling of Wells and Appropriate And Use of Groundwater in New Mexico*. Santa Fe, New Mexico.

New Mexico State Highway and Transportation Department. 1999. Consolidated Highway Database. Transportation Planning Division. February.

New Mexico Traffic Safety Department. 1999. *Otero and Sierra County Community Reports: 1995-1997*. February.

New Mexico Water Quality Control Commission (NMWQCC). 1996. *Water Quality and Water Pollution Control in New Mexico*, prepared for submission to the Congress of the United States. Santa Fe, New Mexico. November 15.

_____. 1975. *Central Closed Basins Plan*.

Ong. 1988. New Mexico Groundwater Quality. *U.S. Geological Survey Open File Report 87-0741*.

- Opler, Morris E. 1983a. Chiricahua Apache. In *Handbook of North American Indians, Volume 10: Southwest*, edited by Alfonso Ortiz, William C. Sturtevant, general editor, pp. 401-418. Smithsonian Institution, Washington, DC.
- _____. 1983b. Mescalero Apache. In *Handbook of North American Indians, Volume 10: Southwest*, edited by Alfonso Ortiz, William C. Sturtevant, general editor, pp. 419-439. Smithsonian Institution, Washington, DC.
- Orr, Brennon R. and Dennis W. Risser. 1992. Geohydrology and Potential Effects of Development of Freshwater Resources in the Northern Part of the Hueco Bolson, Dona Ana and Otero Counties, New Mexico, and El Paso County, Texas. *U.S. Geological Survey Water Resources Investigations Report 91-4082*. Albuquerque, New Mexico.
- Otero County. 1998. *Otero County Comprehensive Plan*.
- Otero County Economic Development Council (OCEDC) Factbook. 1998. Downloaded 1/27/99 from <http://www.alamogordo.com/ocedc>. October.
- Pray, L.C. 1961. Geology of the Sacramento Mountains Escarpment, Otero County, New Mexico, *New Mexico Bureau of Mines and Mineral Resources Bulletin 35*. New Mexico Institute of Mining and Technology. Socorro, New Mexico.
- Pyron, A.J. and J.H. Gray. 1985. Don't ignore the Orogrande; its potential is promising. In *World Oil*, Volume 200, Number 6, May.
- Reeder, H.O. and others. 1959. Annual Water Level Measurements in Observation Wells, 1951-1955, and Atlas of Maps showing changes in Water Levels for Various Periods from Beginning of Record through 1954, New Mexico. Part C, South-Central Closed Basins and Rio Grande Valley. *New Mexico Office of the State Engineer Technical Report 13*.
- Regional Economic Information System (REIS), Bureau of Economic Analysis. 1996, 1997, and 1998. Information downloaded 1/26/99 from <http://govinfo.library.orst.edu>.
- Ross C.A. and J.R.P. Ross. 1986. Paleozoic paleotectonics and sedimentation in Arizona and New Mexico. In *Paleotectonics and sedimentation in the Rocky Mountain region, United States*, edited by J.A. Peterson. *American Association of Petroleum Geologist Memori 41*.
- Sammel E.A. 1979. Occurrence of low-temperature geothermal waters in the United States. In *Assessment of Geothermal Resources of the United States*, edited by L.J.P. Muffler. *U.S. Geological Survey Circular 790*.

Sierra County, New Mexico. 1997-98. Downloaded 2/15/99 from
http://village.globaldrum.com/sierra_newmexico/county.htm.

Sivinski, R. And K. Lightfoot (Eds). 1995. *Inventory of rare and endangered plants in New Mexico. New Mexico Forestry and Resources Conservation, Energy, Minerals, and Natural Resources Department Miscellaneous Publications No. 4.*

Snyder, Patrick. 1999. Personal communication. New Mexico Department of Game and Fish. March 17, 1999.

South Central Council of Governments (COG), New Mexico Planning and Development District 7. 1995. *Statistical Compilation and Profile for Sierra County, City of Truth or Consequences, and Village of Williamsburg.*

South Central New Mexico Council of Governments. 1998. *Overall Economic Development Program.* July.

Southern New Mexico Economic Development District (SNMEDD), information from various dates.

Southwest Technology Development Institute (SWTDI). 1992. *Geothermal Stimulus for Economic Growth in Southwestern New Mexico*, Volume III. SWTDI, New Mexico State University.

Spicer, Edward H. 1962. *Cycles of Conquest: The Impact of Spain, Mexico, and the United States on the Indians of the Southwest, 1533-1960.* University of Arizona Press, Tucson.

Starkey, A.H. and L. Icerman. 1983. *Geothermal Resources of New Mexico.* New Mexico State University Energy Institute. Las Cruces, New Mexico.

State Engineer's Office (SEO). 1999a. Personal communication, D. Hoskins (Dames & Moore) and R. Palmer (Water Rights Division, State of New Mexico Office of the State Engineer) regarding undeclared basin in Otero County. January 26.

_____. 1999b. *Publications and Reports Page*, www.seo.state.nm.us/. Internet Information. January 18, 1999.

_____. 1995. *Appropriation and Use of Groundwater Rules and Regulations.*

- _____. 1957. Reconnaissance of Groundwater Conditions in the Crow Flats Area Otero County, New Mexico. *New Mexico Office of the State Engineer Technical Report Number 8*. Santa Fe, New Mexico. January.
- State of New Mexico, County of Otero Audited Financial Statements*. June 1998. Prepared by Dan Ausitin, Ruidoso, NM.
- State of New Mexico, County of Sierra Financial Statements and Schedules*. June 1998. Prepared by Emmons & Co., Albuquerque, NM.
- Stuart, David E. and Rory P. Gauthier. 1981. *Prehistoric New Mexico: Background for Survey*. Historic Preservation Bureau, Santa Fe.
- Summers, W.K. 1976. Catalog of Thermal Waters in New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Hydrologic Report 4*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Tabet, D.E. and S.J. Frost. 1978. Coal Fields and Mines of New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Resource Map 10*, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Thompson, Thomas H., Richard Chappell and Donald L. Hart Jr. 1984. Maps Showing Distribution of Dissolved Solids and Dominant Chemical Type in Groundwater, Basin and Range Province, New Mexico. *U.S. Geological Survey Water Resources Investigations Report 83-4118-C*.
- Trainer F.W. 1975. Mixing of Thermal and Monthermal Waters in the Margin of the Rio Grande Rift, Jemez Mountains, New Mexico. In Las Cruces Country, New Mexico, edited by W.R. Seager, R.E. Clemons, and J.F. Callender. *New Mexico Geological Society Guidebook No. 26*.
- Urban, D.L. and H.H. Shugart. 1986. Avian demography in mosaic landscapes: modeling paradigm and preliminary results. *Wildlife 2000: modeling habitat relationships of terrestrial vertebrates*. University of Wisconsin Press. Madison.
- U.S. Army. 1998. *McGregor Range, New Mexico Land Withdrawal Renewal: Mineral and Energy Resources Assessment of the McGregor Range*. Prepared through U.S. Army Corps of Engineers, Fort Worth District Environmental Division, Fort Worth, Texas. Prepared by New Mexico Bureau of Mines and Minerals Resources, Socorro, New Mexico and TRC Mariah Associates, Inc. Laramie, Wyoming. August.

- _____. 1997. *Mineral and Energy Resource Assessment of the McGregor Range, New Mexico*, Preliminary Draft, 2 Volumes. Prepared for the U.S. Army, McGregor Range Renewal/Fort Bliss, prepared through U.S. Army Corps of Engineers, Fort Worth District Planning Division by New Mexico Bureau of Mines and Mineral Resources, New Mexico State University, Southwest Technology Development Institute, and TRC Mariah Associates, Inc.
- U.S. Army Corps of Engineers. 1998. *McGregor Range, New Mexico Land Withdrawal Renewal: Mineral and Energy Assessment of the McGregor Range*. August.
- U.S. Bureau of the Census. 1996. USA Counties 1996 CD-ROM. Downloaded 1/27/99 from <http://www.census.gov/statab/USA96/35/051.txt>.
- _____. 1995. County Estimates for People of All Ages in Poverty for New Mexico, 1995. Downloaded 2/17/99 from <http://www.census.gov>.
- _____. 1993. 1993 County Estimates. Downloaded 1/26/99 from <http://www.census.gov>.
- _____. 1990. 1990 Census of Population and Housing. Downloaded on 1/26/99 from <http://www.census.gov>.
- U.S. Department of Agriculture. 1984. *Soil Survey of Sierra County Area, New Mexico*. Soil Conservation Service and Forest Service, in cooperation with U.S. Department of the Interior, Bureau of Land Management, and New Mexico University Agricultural Experiment Station. Issued June 1984.
- _____. 1981. *Soil Survey of Otero Area, New Mexico, Parts of Otero, Eddy, and Chaves Counties*. Soil Conservation Service and Forest Service, in cooperation with the New Mexico University Agricultural Experiment Station. Issued June 1981.
- U.S. Department of Agriculture, Forest Service. 1989. *Landscape Character Types of the National Forests in Arizona and New Mexico: the Visual Management System*. Southwestern Region. November.
- U.S. Department of Agriculture, Forest Service, Southwestern Region. 1996. *Cultural Affiliations: Prehistoric Cultural Affiliations of Southwestern Indian Tribes*. Albuquerque.
- _____. 1996. *Code of Federal Regulations* 43, Part 1000 to End.

U.S. Department of Housing and Urban Development. 1977. Noise Assessment Guideline, Technical Background.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2000. *Proposed Statewide Resource Management Plan Amendment/Final Environmental Impact Statement for New Mexico Standards for Public Land Health for Livestock Grazing Management*. New Mexico State Office, Santa Fe.

_____. 1999a. *Draft Statewide Resource Management Plan Amendment/Environmental Impact Statement for New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management*. New Mexico State Office, Santa Fe.

_____. 1999b. Resource Management Plan Amendment and Environmental Impact Statement (RMPA/EIS) for Fluid Minerals Leasing in Sierra and Otero Counties Scoping Report. January.

_____. 1999c. Letter from biologist, T. Wooten, that nominates Pup Canyon as an Area of Critical Environmental Concern. Las Cruces Field Office file data.

_____. 1999d. Reasonable Foreseeable Development for Federal Fluid Minerals Leasing in Sierra and Otero Counties. Las Cruces Field Office. April.

_____. 1999e. Case Management Audit Reports for Right-of-Way Grants and Mineral Materials Leases. Las Cruces Field Office. March.

_____. 1999f. Recreation and Public Purposes Case Abstracts, as of February.

_____. 1999g. Personnel communication with M. Howard. Las Cruces Field Office.

_____. 1998a. Operator and Grazing Allotment Information. Las Cruces Field Office.

_____. 1998b. Draft Fire Management Plan. Las Cruces Field Office. Phase I. June.

_____. 1998c. Threatened and Endangered Species Data Base. Las Cruces District Office, New Mexico. September. Contact: M. Howard.

_____. 1997a. Noxious Weed Inventory. File data. Las Cruces Field Office.

_____. 1997b. *Otero County Areas of Critical Environmental Concern Resource Management Plan Amendment*. Las Cruces District, Caballo Resource Area. August.

- _____. 1997c. *Roswell District Final Resource Management Plan/Environmental Impact Statement*. January.
- _____. 1996a. *Environmental Assessment Noxious Weed Control: Finding of No Significant Impact*. Caballo Resource Area, Las Cruces District.
- _____. 1996b. *Partners Against Weeds: An Action Plan for the Bureau of Land Management*. Montana State Office, Billings.
- _____. 1995. *Interim Management Policy and Guidelines for Lands Under Wilderness Review*. Government Printing Office. Washington, D.C.
- _____. 1994. *Roswell Resource Area Draft Resource Management Plan/Environmental Impact Statement and Carlsbad Resource Area Draft Resource Management Plan Amendment/Environmental Impact Statement*, Appendix 18, "Impact Analysis Assumptions," prepared by the Roswell District Office. September.
- _____. 1993. *Mimbres Resource Area Management Plan*. December.
- _____. 1991a. *Albuquerque District Proposed Resource Management Plan/Environmental Impact Statement: Oil and Gas Leasing and Development*. December.
- _____. 1991b. *New Mexico Wilderness Study Report: Statewide Summary*. New Mexico State Office, Santa Fe.
- _____. 1990a. *McGregor Range, Resource Management Plan Amendment*. Las Cruces District Office, New Mexico. September.
- _____. 1990b. *Planning for Fluid Mineral Resources, Resource Management Plan*. *BLM Handbook H-1624-1*. Dated May 7
- _____. 1988. *Draft White Sands Resource Management Plan Amendment/Environmental Impact Statement: McGregor Range*. Las Cruces District, White Sands Resource Area. September.
- _____. 1987. *Goal 1 - Overall Habitat Management Program*. *Fish and Wildlife 2000*.
- _____. 1986a. *White Sands Resource Area, Draft Resource Management Plan and Environmental Impact Statement*. Las Cruces District Office, New Mexico. October.

- _____. 1986b. *White Sands Resource Management Plan and McGregor Range Plan Amendment Biological Assessment*. Las Cruces District. June.
- _____. 1985a. *New Mexico Statewide Wilderness Study Draft EIS*. May.
- _____. 1985b. *White Sands Resource Area Draft Resource Management Plan and Environmental Impact Statement*. Las Cruces District, New Mexico.
- _____. 1984. *White Sands Resource Area Management Situation Analysis*. Las Cruces District, New Mexico. April.
- _____. 1983-4. Las Cruces District Inventory Data.
- _____. 1983. *Draft Environmental Assessment: Wilderness Study Areas in the Las Cruces District*. Las Cruces District Office. March.
- _____. 1982. *Oil and Gas and Geothermal Leasing in the White Sands Resource Area*. Environmental Assessment Decision Record. Las Cruces District, New Mexico. May.
- _____. 1981a. *Draft Environmental Assessment, Oil and Gas and Geothermal Leasing in the White Sands Resource Area*.
- _____. 1981b. *Draft Grazing Environmental Impact Statement for the Southern Rio Grande Planning Area*.
- _____. 1981c. *Wilderness Management Policy*. Government Printing Office. Washington, D.C.
- _____. 1980a. *McGregor Range Grazing Draft EIS*. September.
- _____. 1980b. *New Mexico Wilderness Study Area Proposals*. March.
- _____. 1977. *Otero County Areas of Critical Environmental Concern Resource Plan Amendment*.
- U.S. Department of the Interior, Mineral Management Services (MMS). 1999. Federal Mineral Revenue Disbursements to States, Identified by County of Origin, Fiscal Year 1998. MMS Royalty Program.
- _____. 1997. *Federal Mineral Revenue Disbursements, 1997*. Downloaded 1/27/99 from <http://www.mms.gov>.

- U.S. Environmental Protection Agency (EPA). 1999. Aerometric Information Retrieval System, Air Quality Subsystem. *Yearly Maximum Values Report 1998*. March 24, 1999.
- _____. 1980. Noise and Urban Pedestrian Areas.
- _____. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. March.
- U.S. Fish and Wildlife Service (USFWS). 1999. Endangered and threatened wildlife and plants: Proposed threatened status for the mountain plover. *Federal Register*, Volume 64, Number 30. February 16, 1999.
- _____. 1997. Biological Opinion on the Caballo Resource Area Resource Management Plan. Albuquerque, New Mexico.
- U.S. Geological Survey (USGS). 1997. Geological Map of New Mexico. *U.S. Geological Survey Open File Report OF-97-52*.
- Weir, J.E. 1965. Geology and Availability of Ground Water in the Northern Part of the White Sands Missile Range and Vicinity, New Mexico. *U.S. Geological Survey Water Supply Paper* 1801.
- West, S.W., R.L. Cushman, and J.M. Stow. 1965. Mineral Water Resources of New Mexico. *U.S. Geological Survey Bulletin* 87. September 2.
- Wilson, J.L. 1989. Lower and Middle Pennsylvanian strata in the Orogrande and Pedregosa Basins, New Mexico. *New Mexico State Bureau of Mines and Mineral Resources, Bulletin* 124, New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Wilson, John P. 1985. *Between the River and the Mountains: A History of Early Settlement in Sierra County, New Mexico*. John P. Wilson Report No. 40. Las Cruces.
- _____. 1975. *Historical Profile of Southwestern New Mexico*. Department of Sociology and Anthropology, New Mexico State University, Las Cruces.
- Winter, M. and J. Faaborg. 1999. Patterns of area sensitivity in grassland-nesting birds. *Conservation Biology* 13:1424-1436.
- Witcher, J.C. 1998. Personal communication on December 8, 1998 regarding geothermal resources and potential development in Sierra and Otero Counties, New Mexico.

_____. 1988. Geothermal Resources of Southwestern New Mexico and Southeastern Arizona. In Cretaceous and Laramide Tectonic Evaluation of Southwestern New Mexico, edited by G.H. Mack, T.F. Lawton, and S.G. Lucas. *New Mexico Geological Society Guidebook No. 39*.

Zidek, Jiri and Kenneth Kietzke. 1993. Pre-Permian Vertebrates of New Mexico, with Remarks on Some Early Permian Specimens. In *Vertebrate Paleontology in New Mexico, New Mexico Museum of Natural History and Science Bulletin 2*.

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