APPENDIX A — BLM STANDARD STIPULATION/ MITIGATION REQUIREMENTS

A.1 WYOMING BUREAU OF LAND MANAGEMENT (BLM) MITIGATION GUIDELINES FOR SURFACE-DISTURBING AND DISRUPTIVE ACTIVITIES

Introduction

These guidelines are primarily for the purpose of attaining statewide consistency in how requirements are determined for avoiding and mitigating environmental impacts and resource and land use conflicts. Consistency in this sense does not mean that identical requirements would be applied for all similar types of land use activities that may cause similar types of impacts. Nor does it mean that the requirements or guidelines for a single land use activity would be identical in all areas.

There are two ways the mitigation guidelines are used in the resource management plan (RMP) and environmental impact statement (EIS) process: (1) as part of the planning criteria in developing the RMP alternatives, and (2) in the analytical processes of both developing the alternatives and analyzing the impacts of the alternatives. In the first case, an assumption is made that any one or more of the mitigations will be appropriately included as conditions of relevant actions being proposed or considered in each alternative. In the second case, the mitigations are used (1) to develop a baseline for measuring and comparing impacts among the alternatives; (2) to identify other actions and alternatives that should be considered, and (3) to help determine whether more stringent or less stringent mitigations should be considered.

The EIS for the RMP does not decide or dictate the exact wording or inclusion of these guidelines. Rather, the guidelines are used in the RMP EIS process as a tool to help develop the RMP alternatives and to provide a baseline for comparative impact analysis in arriving at RMP decisions. These guidelines will be used in the same manner in analyzing activity plans and other site-specific proposals. These guidelines and their wording are matters of policy. As such, specific wording is subject to change primarily through administrative review, not through the RMP EIS process. Any further changes that may be made in the continuing refinement of these guidelines and any development of program-specific standard stipulations will be handled in another forum, including appropriate public involvement and input.

Purpose

The purposes of the "Wyoming BLM Mitigation Guidelines" are (1) to reserve, for the BLM, the right to modify the operations of all surface and other human presence disturbance activities as part of the statutory requirements for environmental protection, and (2) to inform a potential lessee, permittee, or operator of the requirements that must be met when using BLM-administered public lands. These guidelines have been written in a format that will allow for (1) their direct use as stipulations, and (2) the addition of specific or specialized mitigation following the submission of a detailed plan of development or other project proposal, and an environmental analysis.

Those resource activities or programs currently without a standardized set of permit or operation stipulations can use the mitigation guidelines as stipulations or as conditions of approval, or as a baseline for developing specific stipulations for a given activity or program.

Because use of the mitigation guidelines was integrated into the RMP EIS process and will be integrated into the site-specific environmental analysis process, the application of stipulations or mitigation requirements derived through the guidelines will provide more consistency with planning decisions and plan implementation than has occurred in the past. Application of the mitigation guidelines to all surface and other human presence disturbance activities concerning BLM-administered public lands and resources will provide more uniformity in mitigation than has occurred in the past.

Mitigation Guidelines

1. Surface Disturbance Mitigation Guideline

Surface disturbance will be prohibited in any of the following areas or conditions. Exception, waiver, or modification of this limitation may be approved in writing, including documented supporting analysis, by the Authorized Officer.

- Slopes in excess of 25 percent.
- Within important scenic areas (Class I and II Visual Resource Management Areas).
- Within 500 feet of surface water and/or riparian areas.
- Within either one-quarter mile or the visual horizon (whichever is closer) of historic trails.
- Construction with frozen material or during periods when the soil material is saturated or when watershed damage is likely to occur.

Guidance

The intent of the SURFACE DISTURBANCE MITIGATION GUIDELINE is to inform interested parties (potential lessees, permittees, or operators) that when one or more of the five (1a through 1e) conditions exist, surface-disturbing activities will be prohibited unless or until a permittee or his designated representative and the surface management agency (SMA) arrive at an acceptable plan for mitigation of anticipated impacts. This negotiation will occur prior to development.

Specific criteria (e.g., 500 feet from water) have been established based upon the best information available. However, such items as geographical areas and seasons must be delineated at the field level.

Exception, waiver, or modification of requirements developed from this guideline must be based upon environmental analysis of proposals (e.g., activity plans, plans of development, plans of operation, applications for permit to drill) and, if necessary, must allow for other mitigation to be applied on a site-specific basis.

2. Wildlife Mitigation Guideline

To protect important big game winter habitat, activities or surface use will not be allowed from November 15 to April 30 within certain areas encompassed by the authorization. The same criteria apply to defined big game birthing areas from May 1 to June 30.

- Application of this limitation to operation and maintenance of a developed project must be based on environmental analysis of the operational or production aspects.
- Exception, waiver, or modification of this limitation in any year may be approved in writing, including documented supporting analysis, by the Authorized Officer.

To protect important raptor and/or greater sage-grouse and sharp-tailed grouse nesting habitat, activities or surface use will not be allowed from February 1 to July 31 within certain areas encompassed by the authorization. The same criteria apply to defined raptor and game bird winter concentration areas from November 15 to March 14.

- Application of this limitation to operation and maintenance of a developed project must be based on environmental analysis of the operational or production aspects.
- Exception, waiver, or modification of this limitation in any year may be approved in writing, including documented supporting analysis, by the Authorized Officer.

No activities or surface use will be allowed on that portion of the authorization area identified within (legal description) for the purpose of protecting (e.g., greater sage-grouse/sharp-tailed grouse breeding grounds, and/or other species/activities) habitat.

- Exception, waiver, or modification of this limitation in any year may be approved in writing, including documented supporting analysis, by the Authorized Officer.

Portions of the authorized use area legally described as (legal description), are known or suspected to be essential habitat for (name) which is a threatened or endangered species. Prior to conducting any onsite activities, the lessee/permittee will be required to conduct inventories or studies in accordance with BLM and U.S. Fish and Wildlife Service guidelines to verify the presence or absence of this species. In the event that (name) occurrence is identified, the lessee/permittee will be required to modify operational plans to include the protection requirements of this species and its habitat (e.g., seasonal use restrictions, occupancy limitations, facility design modifications).

Guidance

The WILDLIFE MITIGATION GUIDELINE is intended to provide two basic types of protection: seasonal restriction (2a and 2b) and prohibition of activities or surface use (2c). Item

2d is specific to situations involving threatened or endangered species. Legal descriptions will ultimately be required and should be measurable and legally definable. There are no minimum subdivision requirements at this time. The area delineated can and should be defined as necessary, based upon current biological data, prior to the time of processing an application and issuing the use authorization. The legal description must eventually become a part of the condition for approval of the permit, plan of development, and/or other use authorization.

The seasonal restriction section identifies three example groups of species and delineates three similar time frame restrictions. The big game species including elk, moose, deer, antelope, and bighorn sheep, all require protection of crucial winter range between November 15 and April 30. Elk and bighorn sheep also require protection from disturbance from May 1 to June 30, when they typically occupy distinct calving and lambing areas. Raptors include eagles, accipiters, falcons (peregrine, prairie, and merlin), buteos (ferruginous and Swainson's hawks), osprey, and burrowing owls. The raptors and greater sage-grouse and sharp-tailed grouse require nesting protection between February 1 and July 31. The same birds often require protection from disturbance from November 15 through April 30 while they occupy winter concentration areas.

Item 2c, the prohibition of activity or surface use, is intended for protection of specific wildlife habitat areas or values within the use area that cannot be protected by using seasonal restrictions. These areas or values must be factors that limit life-cycle activities (e.g., greater sage-grouse strutting grounds, known threatened and endangered species habitat).

Exception, waiver, or modification of requirements developed from this guideline must be based upon environmental analysis of proposals (e.g., activity plans, plans of development, plans of operation, applications for permit to drill) and, if necessary, must allow for other mitigation to be applied on a site-specific basis.

3. Cultural Resource Mitigation Guideline

When a proposed discretionary land use has potential for affecting the characteristics which qualify a cultural property for the National Register of Historic Places (National Register), mitigation will be considered. In accordance with Section 106 of the *Historic Preservation Act*, procedures specified in 36 CFR 800 will be used in consultation with the Wyoming State Historic Preservation Officer and the Advisory Council on Historic Preservation in arriving at determinations regarding the need and type of mitigation to be required.

Guidance

The preferred strategy for treating potential adverse effects on cultural properties is "avoidance." If avoidance involves project relocation, the new project area may also require cultural resource inventory. If avoidance is imprudent or unfeasible, appropriate mitigation may include excavation (data recovery), stabilization, monitoring, protection barriers and signs, or other physical and administrative measures.

Reports documenting results of cultural resource inventory, evaluation, and the establishment of mitigation alternatives (if necessary) shall be written according to standards contained in BLM Manuals, the cultural resource permit stipulations, and in other policy issued by the BLM. These reports must provide sufficient information for Section 106 consultation. Reports shall be reviewed for adequacy by the appropriate BLM cultural resource specialist. If cultural properties on, or eligible for, the National Register are located within these areas of potential impact and cannot be avoided, the Authorized Officer shall begin the Section 106 consultation process in accordance with the procedures contained in 36 CFR 800.

Mitigation measures shall be implemented according to the mitigation plan approved by the BLM Authorized Officer. Such plans are usually prepared by the land use applicant according to BLM specifications. Mitigation plans will be reviewed as part of Section 106 consultation for National Register eligible or listed properties. The extent and nature of recommended mitigation shall be commensurate with the significance of the cultural resource involved and the anticipated extent of damage. Reasonable costs for mitigation will be borne by the land use applicant. Mitigation must be cost effective and realistic. It must consider project requirements and limitations, input from concerned parties, and be BLM approved or BLM formulated.

Mitigation of paleontological and natural history sites will be treated on a case-by-case basis. Factors such as site significance, economics, safety, and project urgency must be taken into account when making a decision to mitigate. Authority to protect (through mitigation) such values is provided for in FLPMA, Section 102(a)(8). When avoidance is not possible, appropriate mitigation may include excavation (data recovery), stabilization, monitoring, protection barriers and signs, or other physical and administrative protection measures.

4. Special Resource Mitigation Guideline

To protect (resource value), activities or surface use will not be allowed (i.e., within a specific distance of the resource value or between date to date) in (legal description).

Application of this limitation to operation and maintenance of a developed project must be based on environmental analysis of the operational or production aspects.

Exception, waiver, or modification of this limitation in any year may be approved in writing, including documented supporting analysis, by the Authorized Officer.

Example Resource Categories (Select or identify category and specific resource value):

- Recreation areas.
- Special natural history or paleontological features.
- Special management areas.
- Sections of major rivers.
- Prior existing rights-of-way.
- Occupied dwellings.
- Other (specify).

Guidance

The SPECIAL RESOURCE MITIGATION GUIDELINE is intended for use only in site-specific situations where one of the first three general mitigation guidelines will not adequately address the concern. The resource value, location, and specific restrictions must be clearly identified. A detailed plan addressing specific mitigation and special restrictions will be required prior to disturbance or development and will become a condition for approval of the permit, plan of development, or other use authorization.

Exception, waiver, or modification of requirements developed from this guideline must be based upon environmental analysis of proposals (e.g., activity plans, plans of development, plans of operation, applications for permit to drill) and, if necessary, must allow for other mitigation to be applied on a site-specific basis.

5. No Surface Occupancy Guideline

No Surface Occupancy will be allowed on the following described lands (legal description) because of (resource value).

Example Resource Categories (Select or identify category and specific resource value):

- Recreation Areas (e.g., campgrounds, historic trails, national monuments).
- Major reservoirs/dams.
- Special management area (e.g., known threatened or endangered species habitat, areas suitable for consideration for wild and scenic rivers designation).
- Other (specify).

Guidance

The NO SURFACE OCCUPANCY (NSO) MITIGATION GUIDELINE is intended for use only when other mitigation is determined insufficient to adequately protect the public interest and is the only alternative to "no development" or "no leasing." The legal description and resource value of concern must be identified and be tied to an NSO land use planning decision.

Waiver of, or exception(s) to, the NSO requirement will be subject to the same test used to initially justify its imposition. If, upon evaluation of a site-specific proposal, it is found that less restrictive mitigation would adequately protect the public interest or value of concern, then a waiver or exception to the NSO requirement is possible. The record must show that because conditions or uses have changed, less restrictive requirements will protect the public interest. An environmental analysis must be conducted and documented (e.g., environmental assessment, environmental impact statement, etc., as necessary) in order to provide the basis for a waiver or exception to an NSO planning decision. Modification of the NSO requirement will pertain only to refinement or correction of the location(s) to which it applied. If the waiver, exception, or modification is found to be consistent with the intent of the planning decision, it may be granted. If found inconsistent with the intent of the planning decision, a plan amendment would be required before the waiver, exception, or modification could be granted.

When considering the "no development" or "no leasing" option, a rigorous test must be met and fully documented in the record. This test must be based upon stringent standards described in the land use planning document. Since rejection of all development rights is more severe than the most restrictive mitigation requirement, the record must show that consideration was given to development subject to reasonable mitigation, including "no surface occupancy." The record must also show that other mitigation was determined to be insufficient to adequately protect the public interest. A "no development" or "no leasing" decision should not be made solely because it appears that conventional methods of development would be unfeasible, especially where an NSO restriction may be acceptable to a potential permittee. In such cases, the potential permittee should have the opportunity to decide whether or not to go ahead with the proposal (or accept the use authorization), recognizing that an NSO restriction is involved.

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A.2 LEASE NOTICE NO. 1 (This notice applies to all parcels)

Under Regulation 43 CFR 3101.1-2 and terms of the lease (BLM Form 3100-11), the authorized officer may require reasonable measures to minimize adverse impacts to other resource values, land uses, and users not addressed in lease stipulations at the time operations are proposed. Such reasonable measures may include, but are not limited to, modification of siting or design of facilities, timing of operations, and specification of interim and final reclamation measures, which may require relocating proposed operations up to 200 meters, but not off the leasehold, and prohibiting surface disturbance activities for up to 60 days.

The lands within this lease may include areas not specifically addressed by lease stipulations that may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface and/or other resources. Possible special areas are identified below. Any surface use or occupancy within such special areas will be strictly controlled or, if absolutely necessary, prohibited. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing wells.

1. Slopes in excess of 25 percent

2. Within 500 feet of surface water and/or riparian areas.

3. Construction with frozen material or during periods when the soil material is saturated or when watershed damage is likely to occur.

4. Within 500 feet of Interstate highways and 200 feet of other existing rights-or-way (i.e., U.S. and State highways, roads, railroads, pipelines, powerlines).

5. Within ¼ mile of occupied dwellings.

6. Material sites.

Guidance

The intent of this notice is to inform interested parties (potential lessees, permittees, operators) that when one or more of the above conditions exist, surface disturbing activities will be prohibited unless or until the permittee or the designated representative and the surface management agency (SMA) arrive at an acceptable plan for mitigation of anticipated impacts. This negotiation will occur prior to development and become a condition for approval when authorizing the action.

Specific threshold criteria (e.g., 500 feet from water) have been established based upon the best information available. However, geographical areas and time periods of concern must be delineated at the field level (i.e., “surface water and/or riparian areas” may include both intermittent and ephemeral water sources or may be limited to perennial surface water).
The referenced oil and gas leases on these lands are hereby made subject to the stipulation that the exploration or drilling activities will not interfere materially with the use of the area as a materials site/free use permit. At the time operations on the above lands are commenced, notification will be made to the appropriate agency. The name of the appropriate agency may be obtained from the proper BLM Field Office.

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A.3 SUMMARY TABLE BY SPECIES OF STANDARD STIPULATIONS FOR ALL SURFACE-DISTURBING ACTIVITIES THAT APPLY IN THE JONAH INFILL DRILLING PROJECT AREA

Affected Areas/Species	Restriction	Restricted Dates	Restricted Area
Greater Sage-grouse Leks	No surface occupancy	Year-round	Within ¼ mile of occupied lek boundary
Greater Sage-grouse Leks	No surface-disturbing activity	March 1-May 15	Within ¼ mile of occupied lek boundary
Greater Sage-grouse Nesting Habitat	No surface-disturbing activity	March 15-July 15	Up to 2-mile radius of active lek **OR** within suitable nesting habitat
Winter Greater Sage-grouse Habitat	No surface-disturbing activity	Nov. 15-March 14	Within identified winter habitat
Greater Sage-grouse Leks/Strutting Grounds	Surface occupancy or use restricted or prohibited	March 1-May 15 between 8pm and 8am	Within 0.25 mile of lek/strutting ground boundary
Mountain Plover	No surface-disturbing activity (including reclamation activities) until 2 surveys (done no earlier than 4/20 and 5/4) show no nesting activity; activity must begin within 72 hours after surveys completed	April 10-July 10	Within potential mountain plover habitat
Bald Eagle Nest	No surface occupancy	Year-round	Within 0.5 mile of active nest
Bald Eagle Nest	No surface-disturbing activity	February 1-August 15	Within 1-mile radius
Bald Eagle Winter Use Areas	No surface disturbing activity; disruptive activities restricted	November 15-April 30	Within 1-mile radius
Ferruginous Hawk Nest	No surface occupancy	Year-round	Within 1000 feet of active nest
Ferruginous Hawk Nest	No surface-disturbing activity	February 1-July 31	Within 1.0-mile radius
Other Raptors	No surface occupancy	Year-round	Within 825 feet of active nest
Other Raptors	No surface-disturbing activity	February 1-July 31	Within 0.5-mile radius
National Register of Historic Places Cultural Resource Sites	No surface occupancy	Year-round	Within site boundaries
Riparian Areas	No surface occupancy	Year-round	Within 500 feet
HUD-designated Zone A (100-yr flood hazard area) on intermittent watercourses	Surface occupancy or use restricted or prohibited	Year-round	Within Zone A boundaries

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A.4 INSTRUCTION MEMORANDUM NO. WY-2004-057, STATEMENT OF POLICY REGARDING SAGE-GROUSE DEFINITIONS AND USE OF PROTECTIVE STIPULATIONS AND CONDITIONS OF APPROVAL

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

In Reply Refer To:

6500 (930) P

August 16, 2004

Instruction Memorandum No. WY-2004-057
Expires: 9/30/05

To: Field Managers and Deputy State Directors

From: State Director, Wyoming

Subject: Statement of Policy Regarding Sage-Grouse Management Definitions, and Use of Protective Stipulations, and Conditions of Approval (COAs)

The management of the greater sage-grouse (sage-grouse) and its habitat on western rangelands has become a matter of high public interest in recent years. Since much of the sage-grouse's habitat occurs on Public Lands managed by the Bureau of Land Management (BLM), this species' welfare and management is also of significant concern to our agency. The purpose of this Instruction Memorandum is to provide general guidance and consistency for BLM (Wyoming) Field Offices for the conservation of sage-grouse and their habitats on Public Lands administered by the BLM in Wyoming.

BASIC SAGE-GROUSE HABITAT COMPONENTS AND TERMINOLOGY

To effectively manage for sage-grouse and their habitat it is necessary to have a basic, common, understanding of general sage-grouse biology and their habitat needs.

The following seasonal use periods and habitat components have been identified as important to sage-grouse and contribute to their productivity and conservation. The policy described herein relies heavily on these sage-grouse habitat components and definitions. Breeding and wintering habitats have been identified as limiting factors in sage-grouse populations across their range.

BREEDING HABITATS – Breeding habitats are composed of leks, nesting and early broad rearing habitats.

> **Leks** - A lek (also known as a strutting, or breeding ground) is a traditional courtship display area attended by male sage-grouse in, or adjacent to, sagebrush dominated habitat, and is the location where breeding of females occurs. The lek is typically an open area surrounded by potential nesting habitat. The common feature is that leks have less shrub and herbaceous cover than surrounding habitats. The sagebrush cover that

surrounds the lek provides important hiding cover from predators for both the male sage-grouse and particularly the hen while attending the lek. Sagebrush cover immediately adjacent to the lek may, or may not, meet the following definition of productive, high quality, nesting habitat. The currently accepted Wyoming lek definitions can be found in Attachment 1.

Nesting/Early Brood-Rearing Habitat - Nesting habitat for sage-grouse in Wyoming is generally described as sagebrush that has canopy cover between 15 and 30 percent and heights between 11 and 32 inches. Herbaceous plant height (6 inches or greater) and canopy cover (>15 percent) provide important cover and food for sage-grouse using these habitats. Early brood-rearing habitat generally has 10 to 25 percent sagebrush canopy cover and has slightly higher canopy cover of grasses and forbs than nesting habitat. Early brood-rearing habitat is generally used by sage-grouse hens with chicks when chicks range in age from 1 to 21 days of age.

WINTER HABITATS – During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Sagebrush canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes and windswept ridges.

BACKGROUND

Sage-grouse were once abundant and widespread throughout western North America and are highly dependant upon sagebrush habitats. These populations have decreased significantly range wide, including in Wyoming, during the past 40 years. Land use or habitat management decisions made by BLM directly influence the future of sage-grouse.

Sage-grouse are considered a high priority management species for the Wyoming Game and Fish Department (WGFD) in Wyoming. They are also listed as a sensitive species by BLM (Wyoming). The intent of the BLM (Wyoming) sensitive species designation is to ensure that actions on BLM administered lands consider the welfare of these species and do not contribute to the need to list any sensitive species under the provisions of the Endangered Species Act. This includes avoiding or minimizing adverse impacts and maximizing potential benefits to the species. During the past 5 years, seven petitions have been submitted to the U.S. Fish and Wildlife Service to list sage-grouse as threatened or endangered.

In 1976, the Western Association of Fish and Wildlife Agencies (WAFWA) directed the Sage-Grouse Working Group of this association to establish guidelines for vegetation manipulation of sage-grouse habitat throughout the sage-grouse's range. One of the guidelines promulgated by the group identified the need to protect nesting habitat within 2 miles (3.2 km) of a lek. This assumption was based on studies that indicated between 59 and 87 percent of sage-grouse nests were located within 2 miles (3.2 km) of a lek. These studies were conducted in Montana and Idaho. These guidelines also identified that some sage-grouse nested further than 2 miles from the lek.

Following the development of the 1977 WAFWA Sage Grouse Working Group sage-grouse guidelines, BLM (Wyoming) originally identified a 2-mile radius circle as a flagging device to identify potential sage-grouse nesting habitat that may be impacted by surface disturbance and disruptive activities occurring on public land. This flagging device resulted in the placement of stipulations on oil and gas leases or became part of the COAs of a permit, plan of development, and/or other use authorization that occurred on public lands administered by the BLM in Wyoming. These same use restrictions eventually were incorporated into Land Use Plans (LUPs). This procedure was standardized and directed in BLM (Wyoming) with the adoption of the "*Wyoming BLM Mitigation Guidelines for Surface-Disturbing and Disruptive Activities*" through the development and maintenance of LUPs since 1990. The BLM (Wyoming) mitigation guidelines also allow for other mitigation to be applied for sage-grouse and other species following a site-specific NEPA analysis, if found appropriate.

BLM Field Offices have normally utilized No Surface Occupancy (NSO), Controlled Surface Use (CSU), and Timing Limitation (TLS) lease stipulations, or COAs on specific actions to protect sage-grouse and their habitat within ¼ mile of leks for above ground facilities such as power lines, oil and gas wells, storage tanks, fences, etc. Some disturbances such as low-traffic roads, pipelines, seismic activity, etc., may have been granted exceptions, depending upon site-specific characteristics and type of activity.

Since its inception, many BLM Field Offices in Wyoming have applied conditions of approval to the permit, plan of development, and/or other use authorization for sage-grouse nesting habitat only within the 2-mile radius circle of a lek, regardless of the suitability of nesting habitat both within and outside of that circle. This has usually occurred due to lack of adequate knowledge of sage-grouse nesting habitat requirements, or simply lack of time or manpower to gather onsite information.

Some BLM Field Offices have utilized CSU and TLS lease stipulations or COAs for the protection of winter habitats.

In 1998, the Wyoming Audubon and another individual appealed to the Interior Board of Land Appeals (IBLA) contesting the BLM's use of the ¼ mile NSO or no surface disturbance restrictions for protection of sage-grouse leks. The administrative law judge ruled affirming the BLM's use of the ¼ mile restrictions in the absence of any better compelling science which would warrant other protective measures.

Studies since 1977 indicate that many populations of sage-grouse contained birds nesting much further than 2 miles from the lek of breeding. Studies conducted in Wyoming since 1994 indicate 52 percent of sage-grouse hens nest within 2 miles (3.2 km) of the lek, 67 percent nest within 3 miles (4.8 km), and 78 percent of nests are located within 4 miles (6.4 km) of the lek. Nests are placed independent of lek location, and nest location is based on availability of suitable nesting habitat.

Based on this more recent information, the sage-grouse population and habitat management guidelines were reexamined and revised by the WAFWA in the late 1990s. The newly revised *Guidelines for Management of Sage-grouse Populations and Habitats* (Connelly et al. 2000) also identify the need to determine if sage-grouse populations are migratory or non-migratory in nature. These guidelines also recommend the need to determine if suitable nesting habitat is generally distributed uniformly or irregularly around the lek. As habitats become distributed less uniformly around the lek, sage-grouse hens travel greater distances from the lek to locate nests within suitable nesting habitat. In the event of migratory populations, sage-grouse hens may nest up to 12 to15 miles (18 to 25 km) from the lek.

STATEMENT OF POLICY

Based on the last 4 decades of research, management experience, and legal outcomes and trends, it has become necessary for BLM (Wyoming) to establish some consistent policy and management direction for sage-grouse management on BLM administered Public Lands in the state. For this reason, the following policy is now presented:

1.) Identification and refined mapping of sagebrush ecosystems and sage-grouse seasonal habitats are a high priority for Field Offices to complete. Coordination with the WGFD is critical in the identification of seasonal habitats.

2.) Coordination with WGFD biologists shall be utilized to determine if sage-grouse populations are migratory or non-migratory.

3.) The definitions found in Attachment 1 are adopted by BLM Wyoming to standardize terminology associated with sage-grouse leks in Wyoming. These definitions have also been adopted by the WGFD and should result in improved consistency and communication between the two agencies.

4.) Field Offices shall incorporate recommended management practices from the Wyoming Greater Sage-Grouse Conservation Plan, as appropriate into their LUPs. LUPs should also address the outcome of future local sage-grouse working group plans that are expected to commence this year, to the extent possible. LUPs will develop objectives for maintenance and improvement of sage-grouse habitats and habitats for other BLM (Wyoming) sensitive species. These objectives and associated management practices will be designed to limit loss, degradation, and fragmentation of habitats. Monitoring of sage-grouse habitats and effectiveness of habitat conservation measures will also be addressed in LUPs.

5.) Field offices will continue to utilize the "NSO", "CSU", and "TLS" lease stipulations, where appropriate, as identified in the *Wyoming BLM Mitigation Guidelines for Surface-Disturbing and Disruptive Activities*.

6.) The following distances, and timeframes will hereafter be utilized in all new land use and activity plan development (including revisions), and other resource management implementation actions (authorizations and projects) that involve activities that may impact sage-grouse or their habitats on BLM administered Public Lands in Wyoming. These distances and timeframes are based on current information, and may be subject to change in the future based upon new information.

Sage-grouse leks: 1) Avoid surface disturbance or occupancy within ¼ mile of the perimeter of occupied sage-grouse leks. 2) Avoid human activity between 8 p.m. and 8 a.m. from March 1 – May 15 within ¼ mile of the perimeter of occupied sage-grouse leks.

Sage-grouse nesting/early brood-rearing habitat: Avoid surface disturbing and disruptive activities in suitable sage-grouse nesting and early brood-rearing habitat within two miles of an occupied lek, or in identified sage-grouse nesting and early brood-rearing habitat outside the 2-mile buffer from March 15 – July 15.

Sage-grouse winter habitat: Avoid disturbance and disruptive activities in sage-grouse winter habitat from November 15 – March 14.

Disruptive activities will include, but not be limited to, the following examples: resource surveys that require that personnel be in nesting habitats for longer than 1 hour (e.g., excavation of cultural sites, land surveys, project construction, geophysical activities, permitted or organized recreational activities, prescribed fires, noise, etc.). Field Offices should determine if these guidelines apply to future maintenance and operation of facilities and clearly address maintenance and operation in their LUPs.

Exceptions to control surface use and timing restrictions will continue to be considered on a case-by-case basis. Exception criteria will be established and included in new LUPs and revisions.

7.) BLM (Wyoming) offices will continue to utilize the 2-mile radius circle as a flagging device for applying stipulations or COAs to all disturbance and disruptive activities, where appropriate. Not all sagebrush habitats within this 2-mile radius circle may be suitable as nesting habitat or other seasonal habitats for sage-grouse. Biologists and resource specialists should make management recommendations on sage-grouse habitat characteristics both inside and outside the 2-mile radius circle that involves these seasonal habitats. Upon identification and mapping of nesting habitat, Field Offices will apply appropriate stipulations or conditions of approval for these habitats beyond the 2-mile radius. Site specific evaluations will be conducted. Field Offices will strive to delineate these seasonal habitats regardless of distances from leks. Upon completion of site specific evaluations of projects affecting nesting and early brood-rearing habitats beyond 2 miles from leks, biologists and other resource specialists shall identify and recommend protective and conservation measures for sage-grouse populations and their habitat. These protective and conservation measures may include timing restrictions and reduction, relocation, or elimination of disturbances. These types of protective measures will also be considered for winter habitats.

8.) Biologists and other resource specialists will also work with the project proponents (including those within BLM) to relocate site-specific activities that may be detrimental to leks, nesting/early brood-rearing and winter habitats. These activities should be located to less sensitive habitats wherever necessary and possible. It should be noted that in some circumstances a project may not be re-locatable due to the uniformity of the habitat. In these situations the project should be located in the least sensitive habitat as possible.

9.) Other mitigation/conservation measures should be developed, if appropriate. This effort should be accomplished in conjunction with the WGFD. These measures should be developed to protect, conserve, improve, or mitigate impacts to productive sage-grouse habitat.

10.) All recommendations/mitigation/conservation measures will be analyzed in a site-specific NEPA document, and be incorporated, as appropriate, into conditions of approval of the permit, plan of development, and/or other use authorizations including distances and timeframes identified in item number 6 above for all resource authorizations and actions.

11.) Rehabilitation of surface disturbance activities in nesting/early brood-rearing habitats and winter habitats will include sagebrush (including locally adapted species and subspecies) for rehabilitation activities. Field Offices will include a minimum of one to two species of appropriate forb species in seed mixtures for nesting and early brood-rearing habitats. Appropriate amounts and species will be determined by site potential.

If you have questions concerning this issue or this memorandum, please contact Tom Rinkes of at (307) 332-8404.

Literature Cited: Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28:1-19.

Robert A Bennett

1 Attachment:
  1 – Sage-Grouse Lek Definitions (2 pp.)

<u>Distribution</u>

Director (230), Room 204, LS	1 (w/o atch.)
CF	2 (w/atch.)

Sage-Grouse Lek Definitions

Lek. A traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. Designation of the site as a lek requires observation of two or more male sage-grouse engaged in courtship displays. In addition new leks must be confirmed by a survey conducted during the appropriate time of day and during the strutting season. Observation of sign of strutting activity can also be used to confirm a suspected lek.

Lek Complex. A group of leks in close proximity between which male sage-grouse may be expected to interchange from one day to the next. A specific distance criteria does not yet exist.

Lek Count. A census technique that documents the actual number of male sage-grouse observed on a particular lek or complex of leks using the methods described below.

Lek Survey. A monitoring technique designed primarily to determine whether leks are active or inactive and obtaining accurate counts of the numbers of males attending is secondary.

Annual status – Each year a lek will be determined to be in one of the following status categories:

Active. Any lek that has been attended by male sage-grouse during the strutting season. Presence can be documented by observation of birds using the site or by signs of strutting activity.

Inactive. Leks where it is known that there was no strutting activity through the course of a strutting season. A single visit, or even several visits, without strutting grouse being seen is not adequate documentation to designate a lek as inactive. This designation requires either an absence of birds on the lek during multiple ground visits under ideal conditions throughout the strutting season or a ground check of the exact lek site late in the strutting season that fails to find any sign (droppings/feathers) of strutting activity.

Unknown. Leks that have not been documented either active or inactive during the course of a strutting season.

Based on annual status a lek may be put into one of the following categories for management purposes:

Occupied Lek. A lek that has been active during at least one strutting season within the last 10 years. Management protection will be afforded to occupied leks.

Unoccupied Lek. (Formerly termed "historical lek"). There are two types of unoccupied leks, "destroyed" or "abandoned". Management protection will not be afforded to unoccupied leks.

Destroyed lek: A formerly active lek site and surrounding sagebrush habitat that has been destroyed and no longer capable of supporting sage-grouse breeding activity. A lek site that has been strip-mined, paved, converted to cropland or undergone other long-term habitat type conversion is considered destroyed. Destroyed leks do not require monitoring unless the site is reclaimed to suitable sage-grouse habitat.

Abandoned lek: A lek in otherwise suitable habitat that has not been active during a consecutive ten-year period. Before a lek is designated "abandoned" it must be confirmed as "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the 10 years. Once designated "abandoned," the site should be surveyed at least once every 10 years to determine whether or not the lek has been reoccupied.

Undetermined Lek. Any lek that has not been documented as being active in the last 10 years but does not have sufficient documentation to be designated unoccupied. Management protection will be afforded to undetermined leks until their status has been documented as unoccupied.

APPENDIX B — OPERATOR-COMMITTED PRACTICES

Existing Jonah project *National Environmental Policy Act of 1969* (NEPA) documents (Bureau of Land Management [BLM] 1998b, 2000b) provide various programs and policies that would be implemented to protect the environment during the development and operation of the proposed Jonah Infill Drilling Project (the Project), and Operators have committed to the implementation of these programs and policies under the Proposed Action and various alternatives (see environmental impact statement [EIS] Section 2.15). Additionally, Operators would implement the environmental protection measures identified in the *Wyoming BLM Standard Mitigation Guidelines for Surface-Disturbing Activities* (BLM 1988b; [EIS Appendix A-1]), Lease Notice No. 1 (EIS Appendix A-2), and *Standard Practices Applied to Surface-Disturbing Activities* (BLM 1988b; [EIS Appendix A-3]), as applicable. Some, of the practices identified below are repeated or summarized from these documents with appropriate modifications for this Project, and additional measures have been included.

Many of these environmental protection measures would be included as Conditions of Approval (COAs) in the Record of Decision (ROD) for this project. However, by additionally including them as Operator-committed practices, the Operators have made a commitment to implement them throughout the life-of-project (LOP), and the impact analyses provided in the EIS take into consideration after the implementation of these measures based on this commitment. Additionally, Operators have committed to implementing various practices across all the alternatives analyzed in the EIS as shown in Exhibit B-1.

Where Operator-committed practices differ from and are less rigorous than those provided in previous NEPA documents, the reason for the change is identified.

Some of the Operator-committed practices are outside the jurisdiction of BLM. These practices are identified as *italicized text.*

In addition to Operator-committed environmental protection practices, the various Jonah Infill Drilling Project Area (JIDPA) leases often contain one or more stipulations that obligate the leaseholder. These lease stipulations are mandatory and address a number of issues, including but not limited to seasonal and area restrictions for raptor nests, greater sage-grouse leks and nesting habitat, unstable soils, steep slopes, and controlled surface occupancy (see EIS Appendix A). These lease-specific stipulations may be duplicated by the more general measures listed below.

Exceptions to Operator-committed practices may be granted if a thorough analysis by the BLM determines that the resource(s) for which the measure was developed would not be impacted by the proposed project (see EIS Section 1.3.1.4). Further site-specific mitigation measures may be identified during Application for Permit to Drill (APD) and right-of-way (ROW) application review processes.

To assure compliance with the Operator-committed practices stipulated in this EIS, the project ROD, and in site-specific APDs and ROWs, each Operator would provide qualified individuals to oversee construction and drilling operations and to consult with the BLM on a case-by-case basis, as necessary, during field development.

All of the proposed Operator-committed practices identified in this section would be implemented on all federal lands and minerals within the JIDPA. Development activities on all lands would be conducted in accordance with all appropriate federal, state, and county laws, rules, and regulations.

PRECONSTRUCTION PLANNING AND DESIGN MEASURES

1. Operators would implement the environmental protection measures identified in the *Wyoming BLM Standard Mitigation Guidelines for Surface-Disturbing Activities* (BLM 1988b, [Appendix A-1]), Lease Notice No. 1 (Appendix A-2), and *Standard Practices Applied to Surface-Disturbing Activities* (BLM 1988b [Appendix A-3]), as applicable.

2. Implementation of site-specific projects would be contingent on BLM receiving, for approval/acceptance, the following plans: APD and ROW Surface Use Plans, Plans of Development, and other site-specific plans/reports (e.g., road and well pad design plans, cultural clearances, special status species clearances, etc.); Transportation Plan, Reclamation Plan, and Hazardous Material Summary (BLM 2004a), Wildlife Monitoring/Protection Plan (see BLM 1998b: Appendix D); annual wildlife reports (TRC Mariah Associates Inc. 2004). The above plans may be prepared by Operators for the JIDPA or may be submitted incrementally with each APD, ROW application, or Sundry Notice.

3. Approval of individual project components (i.e., wells, roads, pipelines, and ancillary facilities) would be contingent on completion and acceptance of a site-specific cultural resource literature search, Class III inventory report, and, as necessary, paleontological inventory; threatened, endangered, proposed, and candidate (TEP&C) and BLM Wyoming sensitive (BWS) species surveys; greater sage-grouse lek and nesting clearance; raptor nest clearance; and any other clearance specified by BLM.

4. Operators would include in APD, ROW, or other appropriate permit applications a discussion of site-specific mitigation and environmental protection measures and a map showing specific locations where these measures would be implemented. Final locations for these measures would be confirmed by BLM and the Operators following on-site inspections of project locations.

5. Operators would obtain all necessary federal, state, and county permits, including necessary Spill Prevention and Control Countermeasure Plans (SPCCPs) (EnCana 2002b) and Storm Water Pollution Prevention Plans (SWPPPs) (McMurry Oil Company 2003), to ensure that project development occurs in an environmentally responsible manner.

6. *EnCana Oil and Gas (USA) Inc., BP America Production Company, and potentially other Operators would voluntarily implement an off-site mitigation program in part to offset potential impacts resulting from the project. The off-site mitigation program would involve the funding of projects by an advisory*

board made up of environmental scientists from state agencies (e.g., Wyoming Game and Fish Department (WGFD), local community groups, and members of the environmental and agricultural communities. As currently identified, these projects may entail pronghorn migration corridor protection; greater sage-grouse habitat preservation, protection, and enhancement projects; raptor protection; recreational resource augmentation; conservation easement development; air quality improvement and Air Quality Related Valves (AQRV) projects; on-the-ground reclamation research with an emphasis on sagebrush; and cultural resource projects. The mitigation fund would be established as a trust or similar instrument administered by a non-profit organization to ensure monies are committed to appropriate advisory board-identified on-the-ground mitigation actions. Potential program projects may be proposed by the public, BLM, state agencies, grazing permittees, or other entities. Final approval for projects on BLM-administered lands would rest solely with the BLM.

AIR QUALITY

7. *Regular equipment maintenance, including emissions checks, and regular maintenance of roads would be conducted as necessary throughout the LOF.*

8. *Operators would treat primary access roads (e.g., Luman Road) with dust suppressants (e.g., magnesium chloride) and would water construction sites and well pad access roads as necessary to control fugitive dust during the summer.*

9. *No open burning of garbage or refuse would be allowed at the well sites or other facilities. Any open burning would be conducted under the permitting provisions of Chapter 10, Section 2 of the Wyoming Air Quality Standards and Regulations.*

10. Necessary air quality permits to construct, test, and operate facilities would be obtained from the Wyoming Department of Environmental Quality/Air Quality Division (WDEQ/AQD). All internal combustion equipment would be kept in good working order.

11. *Operators would comply with all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans, including Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS).*

12. *Operators would cooperate with BLM and WDEQ in determining regional oxides of nitrogen (NO_x) emission levels. Adherence to the levels of NO_x emissions analyzed in past NEPA documents is no longer applicable since new emission level estimates are provided for this Project.*

13. *Roads, well pads, and other disturbed areas susceptible to wind erosion would be appropriately surfaced or have dust inhibitors (e.g., magnesium chloride, water) applied to reduce fugitive dust.*

14. *Operators would continue to enforce speed limits (i.e., 35 miles per hour [mph]) to reduce fugitive dust concerns, as well as for human health and safety reasons.*

15. Operators would cooperate with the implementation of any WDEQ-mandated air quality monitoring program or emissions control program.

TOPOGRAPHY

16. Operators would incorporate in their Surface Use Plans and Plans of Development the procedures contained in Standard Practices, Best Management Practices, and Guidelines for Surface Disturbing Activities (BLM 1992a: Appendix 5-1), guidelines for road construction contained in BLM Manual, Section 9113 (BLM 1985, 1991a) and project-specific requirements in the Transportation and Reclamation Plans for this project (BLM 2004a).

17. Unnecessary topographic alterations would be mitigated by avoiding, where practical, steep slopes, rugged topography, and ephemeral/intermittent drainages and by minimizing the size of disturbed areas.

18. Upon completion of construction and/or production activities, Operators would restore the topography to near pre-existing contours at well pads, roads, pipelines, and other facility sites. Water retention structures and other erosion control facilities may be retained if it is determined they are required for maintaining soil stability.

19. No well pads, roads, pipelines, or other facilities would be built within 300 ft of the edge of Sand Draw or within the tall sagebrush areas associated with this drainage, except for crossings that would be done at right angles to the channel, where practical. The number of crossings would also be minimized. The 300-ft buffer is no longer applied to Granite Wash since the resources this measure is designed to protect (i.e., basin big sagebrush habitat, soils with a high potential to contain buried cultural deposits) are not present along the wash in the JIDPA. Alkali Draw is no longer included because it does not occur in the JIDPA.

GEOLOGICAL/PALEONTOLOGICAL RESOURCES

20. Wells, pipelines, and ancillary facilities would be designed and constructed such that they would not be damaged by moderate earthquakes. Any facilities defined as critical, according to the Uniform Building Code, would be constructed in accordance with applicable Uniform Building Code Standards for Seismic Risk Zone 2B.

21. In areas of paleontological sensitivity, a determination would be made by the BLM as to whether a survey by a qualified paleontologist is necessary prior to the disturbance. In some cases, construction monitoring, project relocation, data recovery, or other mitigation may be required to ensure that significant paleontological resources are avoided or recovered during construction.

22. If paleontological resources are uncovered during surface-disturbing activities, Operators would suspend all operations that would further disturb such materials and would immediately contact the BLM, who would arrange for a determination of significance and, if necessary, recommend a recovery or avoidance plan.

Mitigation of impacts to paleontological resources would be on a case-by-case basis, and Operators would either avoid or protect paleontological resources.

23. *Contractors and their workers would be instructed about the potential of encountering fossils and the steps to take if fossils are discovered during project-related activities. The illegality of removing vertebrate fossil materials from federal lands without an appropriate permit would be explained.*

SOILS

24. Operators would adhere to the reclamation guidelines presented in (BLM 2004a). Adverse impacts to soils would be mitigated by minimizing disturbance; avoiding construction with frozen soil materials; avoiding areas with high erosion potential (e.g., unstable soils, dunal areas, slopes greater than 25%, floodplains), where practical; salvaging and selectively handling topsoil from disturbed areas; adequately protecting stockpiled topsoil and replacing it on the surface during reclamation; leaving the soil intact (scalping only) during pipeline construction, where practical; using appropriate erosion and sedimentation control techniques including, but not limited to, diversion terraces, riprap, and matting; and promptly revegetating disturbed areas using native species. Temporary erosion control measures such as temporary vegetation cover; application of mulch, netting, or soil stabilizers; and/or construction of barriers may be used in some areas to minimize wind and water erosion and sedimentation prior to vegetation establishment. Specific measures and locations would be identified in Surface Use Plans, Plans of Development, or Erosion Prevention Plans prepared during APD and/or ROW application processes, and if these plans identify the need for further field investigations, Operators would work with the BLM on the implementation of these studies.

25. Pipeline ROWs would be located to minimize soil disturbance. Where practical, mitigation would include locating ROWs adjacent to access roads to minimize ROW disturbance widths or routing pipeline ROWs directly to minimize disturbance lengths; direct-line routes may be preferable in areas with high wellpad densities.

26. Appropriate erosion control and revegetation measures would be employed (BLM 2004a). Grading and landscaping would be used to minimize slopes, and water bars would be installed on disturbed slopes in areas with unstable soils where seeding alone may not adequately control erosion. Erosion control and revegetation efforts would be monitored by the BLM and Operators and augmented, as necessary, to control erosion and ensure successful establishment of native vegetation.

27. Sufficient topsoil or other suitable material to facilitate revegetation would be segregated from subsoils during all construction operations requiring excavation and would be returned to the surface upon completion of operations. Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut-and-fill sections on all roads and along pipelines would be revegetated with native species.

28. Operators would plan new ground-disturbing activities for periods when soils are not frozen and would work with the BLM on appropriate construction actions in the event that they are proposed for periods when soil frost depths exceed 6.0 inches.

29. Operators would revegetate all disturbed sites as soon as practical following disturbance (BLM 2004a).

30. Operators would restrict off-highway vehicle (OHV) activity by employees and contract workers.

31. Project-related travel would be limited to only that necessary for efficient project operation during periods when soils are saturated and excessive rutting could occur.

32. To prevent reactivation of stabilized dunes, these areas would be avoided where practical, and areas necessarily disturbed would be seeded in the first appropriate season after disturbance. If deemed appropriate by the BLM, disturbed areas would be mulched or otherwise protected to prevent wind erosion and to facilitate plant establishment. Avoidance of development on specific JIDPA soil types is no longer practical due to the anticipated level of development throughout the JIDPA.

33. Reviews of erosion control structures, culverts, reclamation, etc., would be made by Operator personnel and BLM to assure compliance with requirements and goals.

WATER RESOURCES

34. Operators would avoid disturbance within 500 ft of wetlands or riparian areas and open water areas and within 100 ft of ephemeral or intermittent drainages, where practical (exceptions would require BLM approval). Where ephemeral or intermittent channels would be crossed by roads, culverts or low-water crossings would be installed at all appropriate locations as specified in the BLM Manual 9112-Bridges and Major Culverts (BLM 1990a) and Manual 9113-Roads (BLM 1985). Channels would be crossed perpendicular (at right angles) to flow, where practical, and all stream crossing structures would be designed to carry the 25-year discharge event or other capacities as directed by BLM.

35. All non-recycled water used in association with this project would be obtained from Wyoming State Engineer's Office-(WSEO) approved ground water wells, and Project-water use would no result in any reduction to surface water flows.

36. Operators would adhere to guidelines specified in SPCCPs (EnCana 2002b). Any spill or accidental discharge of hazardous material would be remediated. An orientation would be conducted by Operators to ensure that project personnel are aware of the potential impacts that can result from accidental spills and that they know the appropriate recourse if a spill occurs.

37. Erosion-prone areas (e.g., drainages) or high-salinity areas would be avoided where practical, and necessary construction in these areas would be done in the late summer, fall, and winter (prior to soil freezing) to avoid runoff periods. Proper containment of oil and produced water in tanks, drilling and fracturing fluids in tanks or reserve pits, and the location of staging areas for equipment storage away from drainages would prevent potential contaminants from entering surface waters.

38. Prudent use of erosion control measures, including diversion terraces, riprap, matting, temporary sediment traps, and water bars, would be employed as necessary. Interceptor dikes would be used to control surface runoff generated at well pads. Erosion control and construction methods would be described in APD and ROW plans. If necessary to reduce suspended sediment loads and to remove potential contaminants, Operators would treat diverted water in detention ponds prior to release to meet applicable state or federal standards. If water is discharged into an established drainage channel, the rate of discharge would not exceed the capacity of the channel to convey the increased flow without creating erosion induced channel adjustments. Waters that do not meet applicable state or federal standards would be evaporated, treated, or disposed of at an approved disposal facility.

39. Operators would construct reserve pits with 2 ft of freeboard in cut areas or in compacted and stabilized fill. The subsoil material at proposed pit locations would be inspected to assess soil stability and permeability and whether reinforcement and/or lining are required. Prior to installation of reserve pit liners and/or fluids, reserve pits would be inspected by BLM personnel. Unlined earthen reserve pits would be used only after BLM evaluation of the pit location for distance to surface waters, depth to useable ground water, soil type and permeability, and containment fluid content indicate no potential adverse effects to water resources.

40. If reserve pit leakage is detected, operations at the site would be curtailed until the leakage is corrected.

41. All wells would be cased and cemented to protect subsurface mineral and freshwater zones. Unproductive wells and wells that have completed their intended purpose would be properly abandoned and plugged using procedures identified by the Wyoming Oil and Gas Conservation Commission (WOGCC) and the BLM.

42. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 ft below the channel bottom.

43. Channel crossings by roads and pipelines would be constructed perpendicular to flow.

44. Disturbed channel beds would be reshaped to their approximate original configuration.

45. Disposal of all water (hydrostatic test water, stormwater, produced water) would be done in conformance with WDEQ/Water Quality Division (WQD) (1993), BLM *Onshore Oil and Gas Order No. 7*, and WOGCC rules and regulations.

46. Operators would prepare SWPPPs for all disturbances greater than 5 acres in size as required by WDEQ National Pollution Discharge Elimination System (NPDES) permit requirements (EnCana 2003).

47. Operators would implement SPCCPs if liquid petroleum products or other hazardous materials are stored on-site in sufficient quantities, in accordance with 40 C.F.R. 112 (EnCana 2002b).

48. Any disturbances to wetlands and/or waters of the U.S. would be coordinated with the U.S. Army Corps of Engineers (COE), and Section 404 permits would be secured as necessary prior to disturbance.

49. To mitigate potential impacts caused by flooding during the LOF, construction in flood-prone areas would be limited to late summer, fall, or winter when conditions are generally dry and flows are low or nonexistent. Additional mitigation to lessen any impacts from flooding or high flows during and after construction would include the avoidance of areas with high erosion potential (i.e., steep slopes, floodplains, unstable soils); reestablishment of existing contours where practical; avoidance of areas within 500 ft of wetland edges, riparian areas, and open water, where practical; avoidance of areas within 100 ft of ephemeral drainages, where practical; and implementation of appropriate erosion and sediment control and revegetation procedures.

50. Increased sedimentation impacts to surface waters would be avoided or minimized through construction and erosion control practices approved with each authorization and through the prompt reclamation of disturbances.

51. Operators would conduct complete water quality analyses (e.g., pH, alkalinity, total dissolved solids (TDS), oil and grease, benzene, etc.) on all newly developed water wells. Additionally, annual water quality testing at new and existing project-required water wells would be implemented to detect water quality changes, and in the event adverse changes are noted, Operators would work with the BLM on developing and implementing appropriate corrective actions. Water well drilling and quality analysis reports would be submitted by October 1 of each year to the BLM Pinedale Field Office (PFO), SEO, and WDEQ/WQD for review.

NOISE

52. Noise mitigation would be applied at specific well pads, as determined necessary on a case-by-case basis by the BLM.

53. All engines and compressor exhaust stacks would be muffled and maintained according to manufacturers' specifications. Specific requirements for compressor housing and exhaust stack silencers are no longer identified as

Operator-committed; these requirements, if deemed necessary, would be identified in compressor station-specific permit documents.

54. Construction, drilling, completion, testing, and production facility installation activities would be seasonally restricted proximal to active raptor nests during the nesting period and in greater sage-grouse breeding and nesting areas.

55. Road use and travel pattern specifications would be designed, in part, to keep traffic to a minimum and to reduce noise impacts as identified in the Transportation Plan (BLM 2004a).

VEGETATION

56. As required by BLM, Operators would conduct site-specific surveys for TEP&C and BWS plant species (e.g., Ute ladies'-tresses, Cedar Rim thistle) prior to any surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive U.S. Department of Interior [USDI] BLM 6840). TEP&C and BWS species and their habitat would be avoided, where practical. Surveyors would be subject to U.S. Fish and Wildlife Service (USFWS) and/or BLM survey policy requirements. Data from these surveys would be provided to the BLM, and if any TEP&C or BWS plant species or their habitats are found, USFWS and/or BLM recommendations for avoidance or mitigation would be implemented (BWS species) and/or BLM and USFWS would be consulted to determine appropriate avoidance and/or protection measures (TEP&C species).

57. Herbicide applications would be kept at least 500 ft from known BWS plant species populations or other distance deemed safe by the BLM.

58. Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements, limiting equipment/materials storage yard and staging area sizes, etc.). Well pads and associated roads and pipelines would be located to avoid or minimize impacts in areas of high value (e.g., TEP&C or BWS species habitats, wetland/riparian areas).

59. Proper erosion and sediment control structures and techniques would be incorporated by Operators into the design of well pads, roads, pipelines, and other facilities. Revegetation using a BLM-approved, locally adapted seed mixture containing native grasses, forbs, and shrubs would begin in the first appropriate season following disturbance. Vegetation removed would be replaced with plants of similar forage value and growth form using the following procedures:

    - fall reseeding (September 15 to freeze-up), where feasible;
    - spring reseeding (post-thaw and prior to May 15) if fall seeding is not feasible;
    - deep ripping of compacted soils prior to reseeding;

- surface pitting/roughening prior to reseeding;
- utilization of native cool-season grasses, forbs, and shrubs in the seed mix;
- interseeding of shrubs into an established stand of grasses and forbs at least 1 year after seeding the grasses and forbs;
- appropriate, approved weed control techniques;
- broadcast or drill seeding, depending on site conditions; and
- fencing of certain sensitive reclamation sites (e.g., riparian areas, steep slopes, and areas within 0.5 mi of livestock watering facilities) as determined necessary through monitoring.

60. Operators would implement the resource, mitigation, and monitoring measures found in the Transportation and Reclamation Plans (BLM 2004a).

61. Recontouring and seedbed preparation would occur immediately prior to reseeding on the unused portion of well pads and road ROWs and entire pipeline ROWs outside of road ROWs. In the event of uneconomic wells, Operators would initiate reclamation of the entire well pad, access road, and adjacent disturbed habitat as soon as practical. Reclamation would be monitored by the Operators and the BLM, as specified in the Reclamation Plan (BLM 2004a), to determine and ensure successful and timely establishment of vegetation.

62. Traffic would be confined to the running surface of roads and well pads as approved in APDs and ROWs. Operators have and will continue to cooperate with the BLM to identify and prohibit use of two-tracks where ROWs have not been obtained.

63. Operators would monitor noxious weed and invasive non-native species occurrence on the JIDPA and implement a noxious weed/non-native species control program in cooperation with the BLM and Sublette County to ensure noxious weed and non-native species invasion does not become a problem. Weed-free certification by county extension agents would be required for grain or straw used for mulching revegetated areas. Gravel and other surfacing materials used for the project would be free of noxious weeds.

64. Operators would evaluate all project facility sites for occurrence of waters of the U.S., special aquatic sites, and wetlands, per COE requirements. All project activities would be located outside of these areas, where practical.

65. Where wetlands, riparian areas, and ephemeral or intermittent stream channels must be disturbed, COE Section 404 permits would be obtained as necessary, and the following measures would be employed.

    - Wetland areas would be crossed during dry conditions (i.e., late summer, fall, or dry winters); winter construction activities would occur only when topsoil can be segregated and stockpiled separately from the subsoil.

- Channels would be crossed perpendicular to flow.

- Channels, wetlands, and riparian areas disturbed during project construction would be restored to as near pre-project conditions as practical, and if impermeable soils contributed to wetland formation, soils would be compacted to reestablish impermeability.

- Wetland topsoil would be selectively handled.

- Areas would be recontoured and BLM-approved species would be used for reclamation.

- Reclamation activities would begin on disturbed wetland areas immediately after completion of project activities.

WILDLIFE AND FISHERIES

The following practices would be applied for general wildlife protection.

66. Well pads, access roads, pipelines, and ancillary facilities would be located and designed to minimize disturbances to areas of high wildlife habitat value, including wetlands and riparian areas.

67. Areas with high erosion potential and/or rugged topography (i.e., steep slopes, dunes, floodplains, unstable soils) would be avoided, where practical.

68. Removal or disturbance of vegetation would be minimized through construction site management (e.g., by utilizing previously disturbed areas, and existing ROWs where practical, designating limited equipment/materials storage yards and staging areas, vegetation scalping), and Operators would adhere to all reclamation guidelines presented in the Reclamation Plan (BLM 2004a).

69. Operators, in consultation with representatives from BLM, WGFD, USFWS, and other interested groups such as area livestock operators, would adhere to the Wildlife Monitoring/Protection Plan for this project (BLM 1998b: Appendix D) as annually updated (TRC Mariah 2004a). The plan would be incorporated into the Operator field operations manual or handbook, a copy of which would be kept on-site in the JIDPA.

70. *To minimize wildlife mortality due to vehicle collisions, Operators would continue to advise project personnel regarding appropriate speed limits (i.e., 35 mph) in the JIDPA, and roads would be reclaimed as soon as possible after they are no longer required. Some existing roads in the area may be closed and reclaimed by Operators as authorized by BLM. Potential increases in poaching would be minimized through employee and contractor education regarding wildlife laws. If violations are discovered, the offending employee or contractor*

would be disciplined and may be dismissed by Operators and/or prosecuted by WGFD.

71. Reserve, workover, and evaporation pits and other areas potentially hazardous to wildlife would be adequately protected (e.g., netted, fenced) as directed by BLM to prevent access by migratory birds and other wildlife.

72. Firearms and dogs would not be allowed on-site during working hours. Operators would enforce existing drug, alcohol, and firearms policies (EnCana 2002a; Amoco Production Company 1993, 1995).

73. To protect plant populations and wildlife habitat, project-related travel would be restricted to established project roads; no off-road/ROW travel would be allowed, except in emergencies.

74. Wildlife-proof fencing would be utilized on reclaimed areas if it is determined that wildlife species and/or livestock are impeding successful vegetation establishment.

75. ROW fencing associated with this project would be kept to a minimum, and fences, where necessary, would meet BLM and WGFD specifications for facilitating wildlife movement.

76. Potential impacts to fisheries and wetland or riparian areas would be minimized by using proper erosion control techniques (e.g., water bars, jute netting, rip-rap, mulch). Construction within 500 ft of open water, 300 ft of Sand Draw, and 100 ft of other intermittent or ephemeral channels would be avoided, where practical. Channel crossings for roads and pipelines would be constructed during periods of low or no flow (i.e., late summer or fall). All necessary crossings would be constructed perpendicular to flow. No surface water or shallow ground water in connection with surface water would be utilized for the project.

77. As required by BLM, Operators would conduct specific surveys for TEP&C and BWS animal species prior to surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive USDI-BLM 6840). TEP&C and BWS species and their habitat would be avoided, where practical. Surveyors would be subject to USFWS and/or BLM survey policy requirements. Data from these surveys would be provided to the BLM, and if any TEP&C or BWS animal species or their habitats are found, USFWS and/or BLM recommendation for avoidance or mitigation would be implemented (BWS species) and/or BLM and USFWS would be consulted to determine appropriate avoidance and/or protection measures (TEP&C species).

78. Operators would implement policies designed to control poaching and littering and would notify all employees (contract and company) that conviction of a major game violation could result in disciplinary action. Contractors would be informed that any intentional poaching or littering within the JIDPA may result in dismissal.

79. Operators would adhere to all survey, mitigation, and monitoring requirements identified in the Biological Assessment (BA) for this Project.

The following practices would be applied for raptors.

80. Operator consultation and coordination with BLM, USFWS, and WGFD would be conducted for all mitigation activities related to raptor, TEP&C, and BWS species (and their habitats), and all permits required for relocation, removal, and/or establishment of raptor nests would be obtained.

81. Well pads, pipelines, and associated roads would be selected and designed to avoid disturbance to known raptor nest sites.

82. Raptor nest surveys would be conducted within a 1.0-mile radius of proposed surface use or activity areas if such activities are proposed to be conducted between February 1 and July 31.

83. All surface-disturbing activity (e.g., road, pipeline, well pad construction, drilling, completion, workover operations) would be seasonally restricted from February 1 through July 31 within a 0.5-mile radius of all active raptor nests, except ferruginous hawk nests, for which the seasonal buffer would be 1.0 mile. (An active raptor nest is defined as a nest that has been occupied within the past 3 years.) The seasonal buffer distance and applicable exclusion dates may vary, depending on such factors as the activity status of the nest, species involved, prey availability, natural topographic barriers, line-of-site distance(s), and other conflicting issues such as cultural values, steep slopes, etc. Routine maintenance or emergency health and safety activities would be allowed on existing well pads.

84. Well pads, roads, ancillary facilities, and other surface structures requiring repeated human presence would not be constructed within 825 ft of active raptor nests (2,000 ft for bald eagles) where practical. Facility construction in these areas would require specific approval from the BLM.

85. Operators would notify BLM before implementing refracturing, workovers, and/or other routine well site operations requiring more than one day of work during the period of February 1 to July 31 to allow BLM the opportunity to monitor potential impacts from these activities on nesting raptors.

86. Additional mitigation measures for nesting raptors would be designed on a site-specific basis, as necessary, in consultation with the BLM, USFWS, and WGFD. Operators would notify the BLM immediately if raptors are found nesting on project facilities and would assist the BLM as necessary to erect artificial nesting structures.

The following practices would be applied for mountain plover.

87. As directed by BLM and during the period of May 1 through June 15, mountain plover surveys would be conducted by an Operator-financed, BLM-approved biologist in accordance with USFWS guidelines (USFWS 2002) on occupied mountain plover habitat (i.e., areas where plover have been previously recorded)

within the JIDPA and a 0.5-mile buffer and on any potential mountain plover habitat. Currently, one area of occupied plover habitat is known within the JIDPA and a 0.5-mile buffer. Survey procedures would be as follows:

- surveys would be conducted during early courtship and territory establishment;
- surveys would be conducted from sunrise to 10:00 a.m. and/or from 5:30 p.m. to sunset;
- surveys would be conducted from four-wheel-drive vehicles or, where access is a problem and/or no visual observations are made from vehicles, All terrain vehicles (ATVs) would be used;
- surveyors would remain in or close to vehicles when scanning with binoculars;
- sites would be surveyed three times during the survey window (May 1-June 15), with each survey separated by at least 14 days;
- surveys would not be conducted in inclement weather (e.g., poor visibility);
- surveys would focus on locating displaying or calling males;
- global positioning system (GPS) locations of nests (post-nesting) and individuals, if present, would be obtained; and
- all data collected during surveys, including location, surveyor, weather conditions, habitat characteristics, and results, would be recorded on mountain plover survey forms.

88. If breeding birds are observed within 0.25 mile of proposed surface disturbance, additional surveys would be implemented immediately prior to construction to search for active nest sites. If an active nest is located, a 0.25-mile buffer zone would be established around the nest to prevent direct and indirect nest disturbance and planned activities would be delayed 37 days, or 1 week post-hatching (USFWS 2002). If a brood of flightless chicks is observed, activities would be delayed at least 7 days. In areas where no plover are observed, surface-disturbing activities would occur post-survey completion and as near to completion of surveys as possible. Specific avoidance of mountain plover concentration areas and USFWS conferencing regarding development in these areas is no longer identified since the bird is no longer proposed for listing under the *Endangered Species Act* and nest avoidance procedures remain in place. Mountain plover surveys would not be conducted for construction activities planned for the period of July 11 through April 9.

89. Where access roads and/or well locations have been constructed prior to the mountain plover nesting season (April 10-July 10) and development activities have not been initiated prior to April 10, a BLM-approved biologist would

conduct a site investigation of the disturbed area prior to proposed activities to determine whether mountain plover are present. If plover are nesting in the area, Operators would delay development activities until nesting is complete.

90. The nest success and productivity of all mountain plover nests found within the JIDPA would be monitored and reported to the BLM and USFWS Wyoming Field Office annually. Survey results would be compared with annual development plans to determine if any proposed surface-disturbing activities would affect occupied mountain plover nesting habitat. Where feasible, development plans would be modified to avoid nesting habitat (e.g., through road re-alignment).

91. If removal of mountain plover nesting habitat is unavoidable, loss would be minimized by creation of additional nesting habitat; many of the existing and proposed pipeline reclamation areas on the JIDPA likely provide suitable plover breeding habitat. If nesting habitat is disturbed, the area would be reclaimed to approximate original conditions (topography, vegetation, hydrology, etc.) after completion of activities, such that disturbed potential mountain plover breeding habitat is reclaimed to conditions suitable for mountain plover breeding. Operators would minimize road construction and maintenance activities (i.e., grading) in suitable plover habitat from April 10 to July 10.

The following practices would be applied for black-footed ferret.

92. Updates to white-tailed prairie dog town maps within the JIDPA and a 0.5-mile buffer would continue to be annually provided to BLM as identified in annual wildlife study reports (TRC Mariah 2004a).

93. Where practical, surface disturbance in all prairie dog towns would be avoided.

94. Specific requirements for black-footed ferret surveys are no longer specified since the entire JIDPA is included within an area identified by the USFWS as no longer requiring surveys. However, if black-footed ferrets are observed, no further project-specific surface disturbance would occur to the prairie dog complex in which the ferret(s) were observed.

The following measures would be applied for greater sage-grouse, and these measures may be modified, with Operator approval, to facilitate participation in ongoing greater sage-grouse studies.

95. Operators would avoid all surface disturbance (including pipelines) within 0.25 mile of active greater sage-grouse leks.

96. Permanent high-profile structures such as buildings and storage tanks would not be constructed within 0.25 mile of a lek.

97. Greater sage-grouse nest surveys would be implemented during the nesting season (April 1-July 31) by a qualified biologist prior to the start of construction activities in potential greater sage-grouse nesting habitat within 2.0 mile of active

leks, and if an active greater sage-grouse nest is identified, surface-disturbing activities would be delayed until nesting is completed.

98. Operators would avoid optimal greater sage-grouse nesting habitats, where practical. Optimal nesting habitat is defined as areas with sagebrush heights of 20-31 inches and cover of 15-25% and an understory (grasses and forbs) cover of >15%.

99. Operators would avoid all drilling and construction activities during the greater sage-grouse strutting period (March 1-May 15) on areas within 1.0 mile of active leks.

100. Operators would utilize directional drilling to access resources beneath the 0.25-mile active greater sage-grouse lek buffers if reserves beneath these locations are deemed economic.

101. Operators would utilize directional drilling to access resources beneath the 600-ft wide (or tall sagebrush-dominated) buffer associated with the Sand Draw protection areas if deemed economic.

102. Operators would cooperate in ongoing greater sage-grouse studies in the area.

103. Operators would cooperate with the WGFD on existing/new greater sage-grouse habitat improvement efforts within Upland Game Bird Management Area 7 (e.g., water developments).

104. To further mitigate potential adverse effects to breeding and nesting greater sage-grouse on the JIDPA, 0.5-mile facility-free buffers would be applied to greater sage-grouse leks 7 and 8 south of the JIDPA for as long as Operators continue to hold the leases for these areas. No features requiring repeated human presence would be built within these areas.

LIVESTOCK/GRAZING MANAGEMENT

105. Reclamation of nonessential areas disturbed during construction activities would be accomplished in the first appropriate season after well completion. Nonessential areas include portions of the well pads not needed for production operations, the borrow ditch and outslope portions of new road ROWs, entire pipeline ROWs outside of road ROWs, and all roads and associated disturbed areas at nonproductive well pads. Operators would repair or replace fences, cattleguards, gates, drift fences, and natural barriers that are damaged by development actions to maintain current BLM standards. Cattleguards would be used instead of gates for livestock control on most road ROWs. Livestock would be protected from pipeline trenches, and livestock access to existing water sources would be maintained.

106. Operators, in coordination with BLM and livestock permittees, would monitor livestock movements, especially regarding any impacts to livestock from roads or disturbance from construction and drilling activities. Appropriate measures would be taken to correct any adverse impacts, if they occur.

107. All pits containing fluids would be fenced to exclude livestock.

CULTURAL RESOURCES

108. Operators would follow the procedures established by the BLM National Programmatic Agreement/Wyoming State Protocol Agreement (ratified April 1998) for cultural resource management and regulation contained within 36 C.F.R. 800 and would either avoid, protect, or mitigate cultural resource properties.

109. Operators would halt construction activities if previously undetected cultural resource properties are discovered during construction. The BLM would be notified immediately, and consultation with the Wyoming State Historic Preservation Office (SHPO) and/or the Advisory Council on Historic Preservation (ACHP) would be initiated to determine proper mitigation measures pursuant to 36 C.F.R. 800.13 or other Treatment Plans, Programmatic Agreements, or Discovery Plans that may direct such efforts. Construction would not resume until a Notice to Proceed is issued by the BLM.

110. If areas of religious importance, traditional cultural properties, or other sensitive Native American areas are identified in affected areas, BLM would consult with affected tribes and, in further consultation with Operators, would identify potential impacts and determine appropriate mitigative treatments on a case-by-case basis.

111. Operators in cooperation with the BLM would conduct an educational program to inform employees and visitors about the regulations concerning cultural resource management and artifact collection.

112. All recognized eligible sites, areas of Native American concern, and other recognized sensitive areas would be avoided as much as practical during development permitting. Impacts that cannot be eliminated by avoidance would be mitigated on a case-by-case basis through BLM-approved and SHPO-approved methods. Mitigation may include data recovery (including excavation) and/or Native American consultation/coordination for development in sensitive cultural resource areas, and cost for these efforts would be borne by Operators.

113. Construction in archaeologically sensitive areas during frozen ground conditions would not normally be implemented.

114. Operators would work with the BLM, SHPO, and ACHP in developing and implementing appropriate Programmatic Agreements, Research Designs/ Unanticipated Discovery Plans, Treatment Plans, and/or Cultural Resource Management Plans for the protection of cultural resources in the JIDPA.

SOCIOECONOMICS

115. Operators would encourage the use of local or regional workers.

116. Where feasible, Operators would schedule concentrations of project traffic, such as truck convoys or heavy traffic flows, to avoid periods of expected heavy traffic flows associated with recreation.

117. Travel and parking would be restricted to access roads and on-site parking areas.

118. Where feasible, Operators would plan proposed development operations so that seasonal restrictions do not create a significant reduction in the level of development causing seasonal workforce layoffs (i.e., work continues at a consistent rate year-round).

LAND STATUS/USE/PRIOR RIGHTS

Mitigation to prior rights would include the following:

119. limiting drilling operations to lands leased or owned by the Operators;

120. locating wells away from known underground cables;

121. regrading and repairing roads, as necessary, in areas damaged by project activities;

122. reestablishing a level compacted surface where pipelines cross existing roads;

123. advance identification and flagging of all existing ROWs that would be crossed by proposed pipelines and roads;

124. backhoe and hand excavating at pipeline crossings until the exact locations of existing underground lines have been determined; and

125. restoring native vegetation as soon as practical.

126. Roads and pipelines would be located adjacent to existing linear facilities wherever practical; direct-line routes may be preferable in areas with high well pad densities.

127. Portions of existing roads not included in the new road ROW and not needed by other users would be reclaimed and revegetated by Operators, following Class III cultural resource surveys.

128. Adequate turnouts on new crowned-and-ditched roads would be built to provide access to existing two-tracks and other undeveloped roads.

RECREATION

129. Operators would post appropriate warning signs and would require project vehicles to adhere to appropriate speed limits on project-required roads.

130. Operators would inform their employees, contractors, and subcontractors that long-term camping (greater than 14 days) on federal lands or at federal recreation sites is prohibited.

131. Operators would direct their employees, contractors, and subcontractors to abide by all state and federal laws and regulations regarding hunting.

VISUAL RESOURCES

132. Operators would utilize existing topography to screen roads, pipeline corridors, drill rigs, wells, and production facilities from view, where practical.

133. Operators would paint all aboveground production facilities with appropriate colors (e.g., Carlsbad Canyon or other environmental color required by BLM) to blend with adjacent terrain, except for structures that require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements.

TRANSPORTATION

134. Operators would implement the resource, mitigation, and monitoring measures found in the Transportation Plan (BLM 2004a). Annual transportation planning would occur in coordination with efforts required for the Pinedale Anticline Project (BLM 2000c) to identify the minimum road network necessary to support annually proposed project activities; Operator construction and maintenance responsibilities; and road-specific dust abatement, construction, and surfacing requirements.

135. Existing roads would be used to the maximum extent possible and upgraded as necessary.

136. All new and improved roads not required for routine operation and maintenance of producing wells or ancillary facilities would be reclaimed as directed by the BLM, State Land Board, or private landowner. These roads would be permanently blocked, recontoured, reclaimed, and revegetated by Operators, as would disturbed areas associated with permanently plugged and abandoned wells. Reclamation of existing two-track roads would be considered on a case-by-case basis.

137. Site-specific centerline survey and construction designs would be submitted to and approved by the BLM prior to road construction.

138. Operators would comply with existing federal, state, and county requirements and restrictions to protect road networks and the traveling public.

139. Special arrangements would be made with the Wyoming Department of Transportation to transport oversize loads to the project area. Otherwise, load limits would be observed at all times to prevent damage to existing road surfaces.

140. All development activities along approved ROWs would be restricted to areas authorized in the approved ROW.

141. Available topsoil would be stripped from all road corridors prior to commencement of construction activities and would be redistributed and reseeded on backslope areas of the borrow ditch after completion of road construction activities. Borrow ditches would be reseeded in the first appropriate season after initial disturbance.

142. Operators would maximize the use of temporary fresh water pipelines during late spring, summer, and early fall from water wells to active drill sites to decrease water hauling needs.

HEALTH AND SAFETY/HAZARDOUS MATERIALS

143. Operators would utilize WDEQ-approved portable sanitation facilities at drill sites.

144. Operators would place warning signs near hazardous area and along roadways.

145. Operators would place dumpsters at each construction site to collect and store garbage and refuse.

146. Operators would ensure that all refuse and garbage is transported to a state-approved sanitary landfill for disposal.

147. Operators would institute a Hazard Communication Program for its employees and would require subcontractor programs in accordance with OSHA (29 C.F.R. 1910.1200).

148. In accordance with 29 C.F.R. 1910.1200, a Material Safety Data Sheet for every chemical or hazardous material brought on-site would be kept on file at the Operator's field office.

149. SPCCPs would be written and implemented in accordance with 40 C.F.R. 112.

150. Chemical and hazardous materials would be inventoried and reported in accordance with 40 C.F.R. 335. If quantities exceeding 10,000 pounds or the threshold planning quality are to be produced or stored, the appropriate Section 311 and 312 forms would be submitted at the required times to the State and County Emergency Management Coordinators and the local fire departments.

151. Any hazardous wastes, as defined by the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, would be transported and/or disposed of in accordance with all applicable federal, state, and local regulations.

152. Operators would adhere to existing internal health and safety policies and procedures.

153. *Operators would not release fracturing fluids and condensates into flare pits or surrounding areas; they would be confined in the reserve pit or tanks. All reserve pits would be lined unless an exception is granted by the BLM.*

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EXHIBIT B-1:

COMPARISON OF OPERATOR-COMMITTED
PRACTICES ACROSS ALTERNATIVES

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Exhibit B-1 Comparison of Operator-Committed Practices Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
1. Operators would implement the environmental protection measures identified in the *Wyoming BLM Standard Mitigation Guidelines for Surface-Disturbing Activities* (BLM 1988b, [Appendix A-1]), Lease Notice No. 1 (Appendix A-2), and *Standard Practices Applied to Surface-Disturbing Activities* (BLM 1988b [Appendix A-3]), as applicable.	X		X	X	X	X	X	X
2. Implementation of site-specific projects would be contingent on BLM receiving, for approval/acceptance, the following plans: APD and ROW Surface Use Plans, Plans of Development, and other site-specific plans/reports (e.g., road and well pad design plans, cultural clearances, special status species clearances, etc.); Transportation Plan, Reclamation Plan, and Hazardous Material Summary (BLM 2004a); Wildlife Monitoring/Protection Plan (see BLM 1998b: Appendix D; annual wildlife reports [TRC Mariah 2004a]); and Biological Assessment. The above plans may be prepared by Operators for the JIDPA or may be submitted incrementally with each APD, ROW application, or Sundry Notice.	X	X			X		X	X
3. Approval of individual project components (i.e., wells, roads, pipelines, and ancillary facilities) would be contingent on completion and acceptance of a site-specific cultural resource literature search, Class III inventory report, and, as necessary, paleontological inventory; TEP&C and BWS species surveys; greater sage-grouse lek and nesting clearance; raptor nest clearance; and any other clearance specified by BLM.	X	X	X	X	X	X	X	X
4. Operators would include in APD, ROW, or other appropriate permit applications a discussion of site-specific mitigation and environmental protection measures and a map showing specific locations where these measures would be implemented. Final locations for these measures would be confirmed by BLM and the Operators following on-site inspections of project locations.	X	X			X		X	X
5. Operators would obtain all necessary federal, state, and county permits, including necessary SPCCPs (EnCana 2002b) and SWPPPs (McMurry Oil Company 2003), to ensure that project development occurs in an environmentally responsible manner.	X	X	X	X	X	X	X	X
6. EnCana, BP America, and potentially other Operators would voluntarily implement an off-site mitigation program in part to offset potential impacts resulting from the project. The off-site mitigation program would involve the funding of projects by an advisory board made up of environmental scientists from state agencies (e.g., WGFD), local community groups, and members of the environmental and agricultural communities. As currently identified, these projects may entail pronghorn migration corridor protection; greater sage-grouse habitat preservation, protection, and enhancement projects; raptor protection; recreational resource augmentation; conservation easement development; air quality improvement and AQRV monitoring projects; on-the-ground reclamation research with an emphasis on sagebrush; and cultural resource projects. The mitigation fund would be established as a trust or similar instrument administered by a non-profit organization to ensure monies are committed to appropriate advisory board-identified on-the-ground mitigation actions. Potential program projects may be proposed by the public, BLM, state agencies, grazing permittees, or other entities. Final approval for projects on BLM-administered lands would rest solely with the BLM.	X	X		X	X		X	X
7. Regular equipment maintenance, including emissions checks, and regular maintenance of roads would be conducted as necessary throughout the LOF.	X	X			X		X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
8. Operators would treat primary access roads (e.g., Luman Road) with dust suppressants (e.g., magnesium chloride) and would water construction sites and well pad access roads as necessary to control fugitive dust during the summer.	X	X		X	X		X	X
9. No open burning of garbage or refuse would be allowed at the well sites or other facilities. Any open burning would be conducted under the permitting provisions of Chapter 10 Section 12 of the Wyoming Air Quality Standards and Regulations.	X	X			X		X	X
10. Necessary air quality permits to construct, test, and operate facilities would be obtained from the WDEQ/AQD. All internal combustion equipment would be kept in good working order.	X	X	X	X	X	X	X	X
11. Operators would comply with all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans, including Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS).	X	X	X	X	X	X	X	X
12. Operators would cooperate with BLM and WDEQ in determining regional NO_x emission levels.	X	X		X	X		X	X
13. Roads, well pads, and other disturbed areas susceptible to wind erosion would be appropriately surfaced or have dust inhibitors (e.g., magnesium chloride, water) applied to reduce fugitive dust.	X	X			X		X	X
14. Operators would continue to enforce speed limits (i.e., 35 miles per hour [mph]) to reduce fugitive dust concerns, as well as for human health and safety reasons.	X	X	X	X	X	X	X	X
15. Operators would cooperate with the implementation of any WDEQ-mandated air quality monitoring program or emissions control program.	X	X	X	X	X	X	X	X
16. Operators would incorporate in their Surface Use Plans and Plans of Development the procedures contained in *Standard Practices, Best Management Practices, and Guidelines for Surface Disturbing Activities* (BLM 1992a: Appendix 5-1), guidelines for road construction contained in BLM Manual, Section 9113 (BLM 1985, 1991a), and project-specific requirements in the Transportation and Reclamation Plans for this project (BLM 2004a).	X		X	X	X	X	X	X
17. Unnecessary topographic alterations would be mitigated by avoiding, where practical, steep slopes, rugged topography, and ephemeral/ intermittent drainages and by minimizing the size of disturbed areas.	X			X	X		X	X
18. Upon completion of construction and/or production activities, Operators would restore the topography to near preexisting contours at well pads, roads, pipelines, and other facility sites.	X	X			X			X
19. No well pads, roads, pipelines, or other facilities would be built within 300 ft of the edge of Sand Draw or within the tall sagebrush areas associated with this drainage, except for crossings which would be done at right angles to the channel, where practical. The number of crossings would also be minimized.	X				X		X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
20. Wells, pipelines, and ancillary facilities would be designed and constructed such that they would not be damaged by moderate earthquakes. Any facilities defined as critical, according to the Uniform Building Code, would be constructed in accordance with applicable Uniform Building Code Standards for Seismic Risk Zone 2B.	X	X	X	X	X	X	X	X
21. In areas of paleontological sensitivity, a determination would be made by the BLM as to whether a survey by a qualified paleontologist is necessary prior to the disturbance. In some cases, construction monitoring, project relocation, data recovery, or other mitigation may be required to ensure that significant paleontological resources are avoided or recovered during construction.	X	X	X	X	X	X	X	X
22. If paleontological resources are uncovered during surface-disturbing activities, Operators would suspend all operations that would further disturb such materials and would immediately contact the BLM, who would arrange for a determination of significance and, if necessary, recommend a recovery or avoidance plan. Mitigation of impacts to paleontological resources would be on a case-by-case basis, and Operators would either avoid or protect paleontological resources.	X	X		X	X		X	X
23. Contractors and their workers would be instructed about the potential of encountering fossils and the steps to take if fossils are discovered during project-related activities. The illegality of removing vertebrate fossil materials from federal lands without an appropriate permit would be explained.	X	X	X	X	X	X	X	X
24. Operators would adhere to the reclamation guidelines presented in BLM (2004a). Adverse impacts to soils would be mitigated by minimizing disturbance; avoiding construction with frozen soil materials; avoiding areas with high erosion potential (e.g., unstable soils, dunal areas, slopes greater than 25%, floodplains), where practical; salvaging and selectively handling topsoil from disturbed areas; adequately protecting stockpiled topsoil and replacing it on the surface during reclamation; leaving the soil intact (scalping only) during pipeline construction, where practical; using appropriate erosion and sedimentation control techniques including, but not limited to, diversion terraces, riprap, and matting; and promptly revegetating disturbed areas using native species. Temporary erosion control measures such as temporary vegetation cover; application of mulch, netting, or soil stabilizers; and/or construction of barriers may be used in some areas to minimize wind and water erosion and sedimentation prior to vegetation establishment. Specific measures and locations would be identified in Surface Use Plans, Plans of Development, or Erosion Prevention Plans prepared during APD and/or ROW application processes, and if these plans identify the need for further field investigations, Operators would work with the BLM on the implementation of these studies.	X				X		X	X
25. Pipeline ROWs would be located to minimize soil disturbance. Where practical, mitigation would include locating ROWs adjacent to access roads to minimize ROW disturbance widths or routing pipeline ROWs directly to minimize disturbance lengths; direct-line routes may be preferable in areas with high wellpad densities.	X	X				X		X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
26. Appropriate erosion control and revegetation measures would be employed (BLM 2004a). Grading and landscaping would be used to minimize slopes, and water bars would be installed on disturbed slopes in areas with unstable soils where seeding alone may not adequately control erosion. Erosion control and revegetation efforts would be monitored by the BLM and Operators and augmented, as necessary, to control erosion and ensure successful establishment of native vegetation.	X	X			X		X	X
27. Sufficient topsoil or other suitable material to facilitate revegetation would be segregated from subsoils during all construction operations requiring excavation and would be returned to the surface upon completion of operations. Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut and fill sections on all roads and along pipelines would be revegetated with native species.	X	X			X			X
28. Operators would plan new-ground disturbing activities for periods when soils are not frozen and would work with the BLM on appropriate construction actions in the event that they are proposed for periods when soil frost depths exceed 6.0 inches.	X	X			X		X	X
29. Operators would revegetate all disturbed sites as soon as practical following disturbance (BLM 2004a).	X	X			X			X
30. Operators would restrict off-highway vehicle (OHV) activity by employees and contract workers.	X	X			X		X	X
31. Project-related travel would be limited to only that necessary for efficient project operation during periods when soils are saturated and excessive rutting could occur.	X	X			X		X	X
32. To prevent reactivation of stabilized dunes, these areas would be avoided where practical, and areas necessarily disturbed would be seeded in the first appropriate season after disturbance. If deemed appropriate by the BLM, disturbed areas would be mulched or otherwise protected to prevent wind erosion and to facilitate plant establishment.	X				X		X	X
33. Reviews of erosion control structures, culverts, reclamation, etc., would be made by Operator personnel and BLM to assure compliance with requirements and goals.	X	X			X		X	X
34. Operators would avoid disturbance within 500 ft of wetlands/riparian areas and open water areas and within 100 ft of ephemeral/intermittent drainages, where practical. Where ephemeral/intermittent channels would be crossed by roads, culverts would be installed at all appropriate locations as specified in the BLM Manual 9112-Bridges and Major Culverts (BLM 1990a) and Manual 9113-Roads (BLM 1985). Channels would be crossed perpendicular (at right angles) to flow, where practical, and all stream crossing structures would be designed to carry the 25-year discharge event or other capacities as directed by BLM.	X		X		X		X	X
35. All non-recycled water used in association with this project would be obtained from WSEO-approved ground water wells.	X	X	X	X	X	X	X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
36. Operators would adhere to guidelines specified in SPCCPs (EnCana 2002b). Any spill or accidental discharge of hazardous material would be remediated. An orientation would be conducted by Operators to ensure that project personnel are aware of the potential impacts that can result from accidental spills and that they know the appropriate recourse if a spill occurs.	X	X	X	X	X	X	X	X
37. Erosion-prone (e.g., drainages) or high-salinity areas would be avoided where practical, and necessary construction in these areas would be done in the late summer, fall, and winter (prior to soil freezing) to avoid runoff periods. Proper containment of oil and produced water in tanks, drilling and fracturing fluids in tanks or reserve pits, and the location of staging areas for equipment storage away from drainages would prevent potential contaminants from entering surface waters.	X				X			X
38. Prudent use of erosion control measures, including diversion terraces, riprap, matting, temporary sediment traps, and water bars, would be employed as necessary. Interceptor dikes would be used to control surface runoff generated at well pads, and dike location and construction methods would be described in APD and ROW plans. If necessary to reduce suspended sediment loads and to remove potential contaminants, Operators would treat diverted water in detention ponds prior to release to meet applicable state or federal standards. If water is discharged into an established drainage channel, the rate of discharge would not exceed the capacity of the channel to convey the increased flow. Waters that do not meet applicable state or federal standards would be evaporated, treated, or disposed of at an approved disposal facility.	X	X			X		X	X
39. Operators would construct reserve pits with 2 ft of freeboard in cut areas or in compacted and stabilized fill. The subsoil material at proposed pit locations would be inspected to assess soil stability and permeability and whether reinforcement and/or lining are required. Prior to installation of reserve pit liners and/or fluids, reserve pits would be inspected by BLM personnel. Unlined earthen reserve pits would be used only after BLM evaluation of the pit location for distance to surface waters, depth to useable ground water, soil type and permeability, and containment fluid content indicate no potential adverse effects to water resources.	X	X	X	X	X	X	X	X
40. If reserve pit leakage is detected, operations at the site would be curtailed until the leakage is corrected.	X	X	X	X	X	X	X	X
41. All wells would be cased and cemented to protect subsurface mineral and freshwater zones. Unproductive wells and wells that have completed their intended purpose would be properly abandoned and plugged using procedures identified by the WOGCC and the BLM.	X	X	X	X	X	X	X	X
42. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 ft below the channel bottom.	X	X		X	X		X	X
43. Channel crossings by roads and pipelines would be constructed perpendicular to flow.	X	X		X	X		X	X
44. Disturbed channel beds would be reshaped to their approximate original configuration.	X	X		X	X		X	X
45. Disposal of all water (hydrostatic test water, stormwater, produced water) would be done in conformance with WDEQ/WQD (1993), BLM *Onshore Oil and Gas Order No. 7*, and WOGCC rules and regulations.	X	X	X	X	X	X	X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
46. Operators would prepare SWPPPs for all disturbances greater than 5 acres in size as required by WDEQ National Pollution Discharge Elimination System (NPDES) permit requirements (EnCana 2003).	X	X	X	X	X	X	X	X
47. Operators would implement SPCCPs if liquid petroleum products or other hazardous materials are stored on-site in sufficient quantities, in accordance with 40 C.F.R. 112 (EnCana 2002b).	X	X	X	X	X	X	X	X
48. Any disturbances to wetlands and/or waters of the U.S. would be coordinated with the U.S. Army Corps of Engineers (COE), and Section 404 permits would be secured as necessary prior to disturbance.	X	X	X	X	X	X	X	X
49. To mitigate potential impacts caused by flooding during the LOF, construction in flood-prone areas would be limited to late summer, fall, or winter when conditions are generally dry and flows are low or nonexistent. Additional mitigation to lessen any impacts from flooding or high flows during and after construction would include the avoidance of areas with high erosion potential (i.e., steep slopes, floodplains, unstable soils); reestablishment of existing contours where practical; avoidance of areas within 500 ft of wetland edges, riparian areas, and open water, where practical; avoidance of areas within 100 ft of ephemeral drainages, where practical; and implementation of appropriate erosion and sediment control and revegetation procedures.	X				X		X	X
50. Increased sedimentation impacts to surface waters would be avoided or minimized through construction and erosion control practices approved with each authorization and through the prompt reclamation of disturbances.	X	X		X	X			X
51. Operators would conduct complete water quality analyses (e.g., pH, alkalinity, TDS, oil and grease, benzene, etc.) on all newly developed water wells. Additionally, annual water quality testing at new and existing project-required water wells would be implemented to detect water quality changes, and in the event adverse changes are noted, Operators would work with the BLM on developing and implementing appropriate corrective actions. Water well drilling and quality analysis reports would be submitted by October 1 of each year to the BLM PFO, SEO, and WDEQ-WQD for review.	X	X			X			X
52. Noise mitigation would be applied at specific well pads, as determined necessary on a case-by-case basis by the BLM.	X				X			X
53. All engines and compressor exhaust stacks would be muffled and maintained according to manufacturers' specifications.	X	X		X	X		X	X
54. Construction, drilling, completion, testing, and production facility installation activities would be seasonally restricted proximal to active raptor nests during the nesting period and in greater sage-grouse breeding and nesting areas.	X		X		X		X	X
55. Road use and travel pattern specifications would be designed, in part, to keep traffic to a minimum and to reduce noise impacts as identified in the Transportation Plan (BLM 2004a).	X	X			X			X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
56. As required by BLM, Operators would conduct site-specific surveys for TEP&C and BWS plant species (e.g., Ute ladies'-tresses, Cedar Rim thistle) prior to any surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive USDI BLM 6840). TEP&C and BWS species and their habitat would be avoided, where practical. Surveyors would be subject to USFWS and/or BLM survey policy requirements. Data from these surveys would be provided to the BLM, and if any TEP&C or BWS plant species or their habitats are found, USFWS and/or BLM recommendations for avoidance or mitigation would be implemented (BWS species) and/or BLM and USFWS would be consulted to determine appropriate avoidance and/or protection measures (TEP&C species).	X	X	X	X	X	X	X	X
57. Herbicide applications would be kept at least 500 ft from known BWS plant species populations or other distance deemed safe by the BLM.	X	X	X	X	X	X	X	X
58. Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements, limiting equipment/materials storage yard and staging area sizes, etc.). Well pads and associated roads and pipelines would be located to avoid or minimize impacts in areas of high value (e.g., TEP&C or BWS species habitats, wetland/riparian areas).	X		X		X		X	X
59. Proper erosion and sediment control structures and techniques would be incorporated by Operators into the design of well pads, roads, pipelines, and other facilities. Revegetation using a BLM-approved, locally adapted seed mixture containing native grasses, forbs, and shrubs would begin in the first appropriate season following disturbance. Vegetation removed would be replaced with plants of similar forage value and growth form using procedures that include: • fall reseeding (September 15 to freeze-up), where feasible; • spring reseeding (post-thaw and prior to May 15) if fall seeding is not feasible; • deep ripping of compacted soils prior to reseeding; • surface pitting/roughening prior to reseeding; • utilization of native cool-season grasses, forbs, and shrubs in the seed mix; • interseeding of shrubs into an established stand of grasses and forbs at least 1 year after seeding the grasses and forbs; • appropriate, approved weed control techniques; • broadcast or drill seeding, depending on site conditions; and • fencing of certain sensitive reclamation sites (e.g., riparian areas, steep slopes, and areas within 0.5 mile of livestock watering facilities) as determined necessary through monitoring.	X	X		X	X		X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
60. Operators would implement the resource, mitigation, and monitoring measures found in the Transportation and Reclamation Plans (BLM 2004a).	X			X	X		X	X
61. Recontouring and seedbed preparation would occur immediately prior to reseeding on the unused portion of well pads and road ROWs and entire pipeline ROWs outside of road ROWs. In the event of uneconomic wells, Operators would initiate reclamation of the entire well pad, access road, and adjacent disturbed habitat as soon as practical. Reclamation would be monitored by the Operators and the BLM, as specified in the Reclamation Plan (BLM 2004a), to determine and ensure successful and timely establishment of vegetation.	X	X		X	X			X
62. Traffic would be confined to the running surface of roads and well pads as approved in APDs and ROWs. Operators have and will continue to cooperate with the BLM to identify and prohibit use of two-tracks where ROWs have not been obtained.	X	X	X	X	X	X	X	X
63. Operators would monitor noxious weed and invasive non-native species occurrence on the JIDPA and implement a noxious weed/non-native species control program in cooperation with the BLM and Sublette County to ensure noxious weed and non-native species invasion does not become a problem. Weed-free certification by county extension agents would be required for grain or straw used for mulching revegetated areas. Gravel and other surfacing materials used for the project would be free of noxious weeds.	X	X		X	X		X	X
64. Operators would evaluate all project facility sites for occurrence of waters of the U.S., special aquatic sites, and wetlands, per COE requirements. All project activities would be located outside of these areas, where practical.	X	X	X	X	X	X	X	X
65. Where wetlands, riparian areas, and ephemeral/intermittent stream channels must be disturbed, COE Section 404 permits would be obtained as necessary, and the following measures would be employed. • Wetland areas would be crossed during dry conditions (i.e., late summer, fall, or dry winters); winter construction activities would occur only when topsoil can be segregated and stockpiled separately from the subsoil. • Channels would be crossed perpendicular to flow. • Channels, wetlands, and riparian areas disturbed during project construction would be restored to as near pre-project conditions as practical, and if impermeable soils contributed to wetland formation, soils would be compacted to reestablish impermeability. • Wetland topsoil would be selectively handled. • Areas would be recontoured and BLM-approved species would be used for reclamation. • Reclamation activities would begin on disturbed wetland areas immediately after completion of project activities.	X	X	X	X	X	X	X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
66. Well pads, access roads, pipelines, and ancillary facilities would be located and designed to minimize disturbances to areas of high wildlife habitat value, including wetlands and riparian areas.	X				X		X	X
67. Areas with high erosion potential and/or rugged topography (i.e., steep slopes, dunes, floodplains, unstable soils) would be avoided, where practical.	X		X		X		X	X
68. Removal or disturbance of vegetation would be minimized through construction site management (e.g., by utilizing previously disturbed areas and existing ROWs where practical, designating limited equipment/materials storage yards and staging areas, vegetation scalping), and Operators would adhere to all reclamation guidelines presented in the Reclamation Plan (BLM 2004a).	X		X X		X		X	X
69. Operators, in consultation with representatives from BLM, WGFD, USFWS, and other interested groups such as area livestock operators, would adhere to the Wildlife Monitoring/Protection Plan for this project (BLM 1998b: Appendix D) as annually updated (TRC Mariah 2004a). The plan would be incorporated into the Operator field operations manual or handbook, a copy of which would be kept on-site in the JIDPA.	X				X			X
70. To minimize wildlife mortality due to vehicle collisions, Operators would continue to advise project personnel regarding appropriate speed limits (i.e., 35 mph) in the JIDPA, and roads would be reclaimed as soon as possible after they are no longer required. Some existing roads in the area may be closed and reclaimed by Operators as authorized by BLM. Potential increases in poaching would be minimized through employee and contractor education regarding wildlife laws. If violations are discovered, the offending employee or contractor would be disciplined and may be dismissed by Operators and/or prosecuted by WGFD.	X	X		X	X		X	X
71. Reserve, workover, and evaporation pits and other areas potentially hazardous to wildlife would be adequately protected (e.g., netted, fenced) as directed by BLM to prevent access by migratory birds and other wildlife.	X	X	X	X	X	X	X	X
72. Firearms and dogs would not be allowed on-site during working hours. Operators would enforce existing drug, alcohol, and firearms policies (EnCana 2002a; Amoco Production Company 1993, 1995).	X	X	X	X	X	X	X	X
73. To protect plant populations and wildlife habitat, project-related travel would be restricted to established project roads; no off-road/ROW travel would be allowed, except in emergencies.	X	X		X	X		X	X
74. Wildlife-proof fencing would be utilized on reclaimed areas if it is determined that wildlife species and/or livestock are impeding successful vegetation establishment.	X	X		X	X		X	X
75. ROW fencing associated with this project would be kept to a minimum, and fences, where necessary, would meet BLM and WGFD specifications for facilitating wildlife movement.	X	X		X	X		X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
76. Potential impacts to fisheries and wetland/riparian areas would be minimized by using proper erosion control techniques (e.g., water bars, jute netting, rip-rap, mulch). Construction within 500 ft of open water, 300 ft of Sand Draw, and 100 ft of other intermittent or ephemeral channels would be avoided, where practical. Channel crossings for roads and pipelines would be constructed during periods of low or no flow (i.e., late summer or fall). All necessary crossings would be constructed perpendicular to flow. No surface water or shallow ground water in connection with surface water would be utilized for the project.	X		X		X		X	X
77. As required by BLM, Operators would conduct specific surveys for TEP&C and BWS animal species prior to surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive USDI BLM 6840). TEP&C and BWS species and their habitat would be avoided, where practical. Surveyors would be subject to USFWS and/or BLM survey policy requirements. Data from these surveys would be provided to the BLM, and if any TEP&C or BWS animal species or their habitats are found, USFWS and/or BLM recommendation for avoidance or mitigation would be implemented (BWS species) and/or BLM and USFWS would be consulted to determine appropriate avoidance and/or protection measures (TEP&C species).	X	X	X	X	X	X	X	X
78. Operators would implement policies designed to control poaching and littering and would notify all employees (contract and company) that conviction of a major game violation could result in disciplinary action. Contractors would be informed that any intentional poaching or littering within the JIDPA may result in dismissal.	X	X	X	X	X	X	X	X
79. Operators would adhere to all survey, mitigation, and monitoring requirements identified in the BA for this project.	X				X			X
80. Operator consultation and coordination with BLM, USFWS and WGFD would be conducted for all mitigation activities related to raptor, TEP&C, and BWS species (and their habitats), and all permits required for relocation, removal, and/or establishment of raptor nests would be obtained.	X	X	X	X	X	X	X	X
81. Well pads, pipelines, and associated roads would be selected and designed to avoid disturbance to known raptor nest sites.	X		X	X	X	X	X	X
82. Raptor nest surveys would be conducted within a 1.0-mi radius of proposed surface use or activity areas if such activities are proposed to be conducted between February 1 and July 31.	X	X	X	X	X	X	X	X
83. All surface-disturbing activity (e.g., road, pipeline, well pad construction, drilling, completion, workover operations) would be seasonally restricted from February 1 through July 31 within a 0.5-mi radius of all active raptor nests, except ferruginous hawk nests, for which the seasonal buffer would be 1.0 mi. (An active raptor nest is defined as a nest that has been occupied within the past 3 years.) The seasonal buffer distance and applicable exclusion dates may vary, depending on such factors as the activity status of the nest, species involved, prey availability, natural topographic barriers, line-of-site distance(s), and other conflicting issues such as cultural values, steep slopes, etc. Routine maintenance or emergency health and safety activities would be allowed on existing well pads.	X		X	X	X	X	X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
84. Well pads, roads, ancillary facilities, and other surface structures requiring repeated human presence would not be constructed within 825 ft of active raptor nests (2,000 ft for bald eagles). Facility construction in these areas would require specific approval from the BLM.	X		X	X	X	X	X	X
85. Operators would notify BLM before implementing refracturing, workovers, and/or other routine well site operations requiring more than one day of work during the period of February 1 to July 31 to allow BLM the opportunity to monitor potential impacts from these activities on nesting raptors.	X		X		X		X	X
86. Additional mitigation measures for nesting raptors would be designed on a site-specific basis, as necessary, in consultation with the BLM, USFWS, and WGFD. Operators would notify the BLM immediately if raptors are found nesting on project facilities and would assist the BLM as necessary to erect artificial nesting structures.	X				X			X
87. As directed by BLM, during the period of May 1-June 15, mountain plover surveys would be conducted by an Operator-financed, BLM-approved biologist in accordance with USFWS guidelines (USFWS 2002) on occupied mountain plover habitat (i.e., areas where plover have been previously recorded) within the JIDPA and a 0.5-mi buffer and on any potential mountain plover habitat. Currently, one area of occupied plover habitat is known within the JIDPA and a 0.5-mi buffer.	X	X			X			X
88. If breeding birds are observed within 0.25 mile of proposed surface disturbance, additional surveys would be implemented immediately prior to construction to search for active nest sites. If an active nest is located, a 0.25-mi buffer zone would be established around the nest to prevent direct and indirect nest disturbance and planned activities would be delayed 37 days, or 1 week post-hatching (USFWS 2002). If a brood of flightless chicks is observed, activities would be delayed at least 7 days. In areas where no plover are observed, surface-disturbing activities would occur post-survey completion and as near to completion of surveys as possible. Mountain plover surveys would not be conducted for construction activities planned for the period of July 11 through April 9.	X				X			X
89. Where access roads and/or well locations have been constructed prior to the mountain plover nesting season (April 10-July 10) and development activities have not been initiated prior to April 10, a BLM-approved biologist would conduct a site investigation of the disturbed area prior to proposed activities to determine whether mountain plover are present. If plover are nesting in the area, Operators would delay development activities until nesting is complete.	X				X			X
90. The nest success and productivity of all mountain plover nests found within the JIDPA would be monitored and reported to the BLM and USFWS Wyoming Field Office annually. Survey results would be compared with annual development plans to determine if any proposed surface-disturbing activities would affect occupied mountain plover nesting habitat. Where feasible, development plans would be modified to avoid nesting habitat (e.g., through road re-alignment).	X				X			X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
91. If removal of mountain plover nesting habitat is unavoidable, loss would be minimized by creation of additional nesting habitat; many of the existing and proposed pipeline reclamation areas on the JIDPA likely provide suitable plover breeding habitat. If nesting habitat is disturbed, the area would be reclaimed to approximate original conditions (topography, vegetation, hydrology, etc.) after completion of activities, such that disturbed potential mountain plover breeding habitat is reclaimed to conditions suitable for mountain plover breeding. Operators would minimize road construction and maintenance activities (i.e., grading) in suitable plover habitat from April 10 to July 10.	X	X			X			X
92. Updates to white-tailed prairie dog town maps within the JIDPA and a 0.5-mi buffer would continue to be annually provided to BLM as identified in annual wildlife study reports (TRC Mariah 2004a).	X	X			X			X
93. Where practical, surface disturbance in all prairie dog towns would be avoided.	X				X			X
94. If black-footed ferrets are found, no further project-specific surface disturbance would occur to the prairie dog complex in which the ferret(s) were observed.	X				X			X
95. Operators would avoid all surface disturbance (including pipelines) within 0.25 mile of active greater sage-grouse leks.	X				X			X
96. Permanent high-profile structures such as buildings and storage tanks would not be constructed within 0.25 mile of a lek.	X				X			X
97. Greater sage-grouse nest surveys would be implemented during the nesting season (April 1-July 31) by a qualified biologist prior to the start of construction activities in potential greater sage-grouse nesting habitat within 2.0 miles of active leks, and if an active greater sage-grouse nest is identified, surface-disturbing activities would be delayed until nesting is completed.	X				X			X
98. Operators would avoid optimal greater sage-grouse nesting habitats, where practical. Optimal nesting habitat is defined as areas with sagebrush heights of 20-31 inches and cover of 15-25% and an understory (grasses and forbs) cover of >15%.	X				X			X
99. Operators would avoid all drilling and construction activities during the greater sage-grouse strutting period (March 1-May 15) on areas within 1.0 mile of active leks.	X				X			X
100. Operators would utilize directional drilling to access resources beneath the 0.25-mi active greater sage-grouse lek buffers if reserves beneath these locations are deemed economic.	X				X			X
101. Operators would utilize directional drilling to access resources beneath the 600-ft wide (or tall sagebrush-dominated) buffer associated with the Sand Draw protection areas if deemed economic.	X				X			X
102. Operators would cooperate in ongoing greater sage-grouse studies in the area.	X	X		X	X		X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
103. Operators would cooperate with the WGFD on existing/new greater sage-grouse habitat improvement efforts within Upland Game Bird Management Area 7 (e.g., water developments).	X	X			X			X
104. To further mitigate potential adverse effects to breeding and nesting greater sage-grouse on the JIDPA, 0.5-mi facility-free buffers would be applied to greater sage-grouse leks 7 and 8 south of the JIDPA for as long as Operators continue to hold the leases for these areas. No features requiring repeated human presence would be built within these areas.	X	X			X			X
105. Reclamation of nonessential areas disturbed during construction activities would be accomplished in the first appropriate season after well completion. Nonessential areas include portions of the well pads not needed for production operations, the borrow ditch and outslope portions of new road ROWs, entire pipeline ROWs outside of road ROWs, and all roads and associated disturbed areas at nonproductive well pads. Operators would repair or replace fences, cattleguards, gates, drift fences, and natural barriers that are damaged by development actions to maintain current BLM standards. Cattleguards would be used instead of gates for livestock control on most road ROWs. Livestock would be protected from pipeline trenches, and livestock access to existing water sources would be maintained.	X	X		X	X			X
106. Operators, in coordination with BLM and livestock permittees would monitor livestock movements, especially regarding any impacts to livestock from roads or disturbance from construction and drilling activities. Appropriate measures would be taken to correct any adverse impacts, if they occur.	X	X			X			X
107. All pits containing fluids would be fenced to exclude livestock.	X	X	X	X	X	X	X	X
108. Operators would follow the procedures established by the BLM National Programmatic Agreement/Wyoming State Protocol Agreement (ratified April 1998) for cultural resource management and regulation contained within 36 C.F.R. 800 and would either avoid, protect, or mitigate cultural resource properties.	X	X	X	X	X	X	X	X
109. Operators would halt construction activities if previously undetected cultural resource properties are discovered during construction. The BLM would be notified immediately, and consultation with the Wyoming State Historic Preservation Office (SHPO) and Advisory Council on Historic Preservation (ACHP) would be initiated to determine proper mitigation measures pursuant to 36 C.F.R. 800.13 or other Treatment Plans, Programmatic Agreements, or Discovery Plans that may direct such efforts. Construction would not resume until a Notice to Proceed is issued by the BLM.	X	X	X	X	X	X	X	X
110. If areas of religious importance, traditional cultural properties, or other sensitive Native American areas are identified in affected areas, BLM would consult with affected tribes and, in further consultation with Operators, would identify potential impacts and determine appropriate mitigative treatments on a case-by-case basis.	X	X	X	X	X	X	X	X
111. Operators in cooperation with the BLM would conduct an educational program to inform employees and visitors about the regulations concerning cultural resource management and artifact collection.	X	X	X	X	X	X	X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
112. All recognized eligible sites, areas of Native American concern, and other recognized sensitive areas would be avoided as much as practical during development permitting. Impacts that cannot be eliminated by avoidance would be mitigated on a case-by-case basis through BLM- and SHPO-approved methods. Mitigation may include data recovery (including excavation) and/or Native American consultation/coordination for development in sensitive cultural resource areas, and cost for these efforts would be borne by Operators.	X	X	X	X	X	X	X	X
113. Construction in archaeologically sensitive areas during frozen ground conditions would not normally be implemented; exceptions would be considered by the BLM on a case-by-case basis and granted if appropriate.	X				X		X	X
114. Operators would work with the BLM, SHPO, and ACHP in developing and implementing appropriate Programmatic Agreements, Research Designs/Unanticipated Discovery Plans, Treatment Plans, and/or Cultural Resource Management Plans for the protection of cultural resources in the JIDPA.	X	X	X		X		X	X
115. Operators would encourage the use of local or regional workers.	X	X		X	X		X	X
116. Where feasible, Operators would schedule concentrations of project traffic, such as truck convoys or heavy traffic flows, to avoid periods of expected heavy traffic flows associated with recreation.	X	X			X			X
117. Travel and parking would be restricted to access roads and on-site parking areas.	X	X		X	X		X	X
118. Where feasible, Operators would plan proposed development operations so that seasonal restrictions do not create a significant reduction in the level of development causing seasonal workforce layoffs (i.e., work continues at a consistent rate year-round).	X	X			X			X
119. Limit drilling operations to lands leased or owned by the Operators.	X	X	X	X	X	X	X	X
120. Locate wells away from known underground cables.	X	X	X	X	X	X	X	X
121. Regrade and repair roads, as necessary, in areas damaged by project activities.	X	X		X	X		X	X
122. Reestablish a level compacted surface where pipelines cross existing roads.	X	X		X	X		X	X
123. Identify and flag in advance all existing ROWs that would be crossed by proposed pipelines and roads.	X	X	X	X	X	X	X	X
124. Backhoe and hand excavate at pipeline crossings until the exact locations of existing underground lines have been determined.	X	X	X	X	X	X	X	X
125. Restore native vegetation as soon as practical.	X	X		X	X			X
126. Roads and pipelines would be located adjacent to existing linear facilities wherever practical; direct-line routes may be preferable in areas with high well pad densities.	X	X		X	X		X	X
127. Portions of existing roads not included in the new road ROW and not needed by other users would be reclaimed and revegetated by Operators, following Class III cultural resource surveys.	X	X			X			X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
128. Adequate turnouts on new crowned-and-ditched roads would be built to provide access to existing two-tracks and other undeveloped roads.	X	X			X			X
129. Operators would post appropriate warning signs and would require project vehicles to adhere to appropriate speed limits on project-required roads.	X	X		X	X		X	X
130. Operators would inform their employees, contractors, and subcontractors that long-term camping (greater than 14 days) on federal lands or at federal recreation sites is prohibited.	X	X		X	X		X	X
131. Operators would direct their employees, contractors, and subcontractors to abide by all state and federal laws and regulations regarding hunting.	X	X	X	X	X	X	X	X
132. Operators would utilize existing topography to screen roads, pipeline corridors, drill rigs, wells, and production facilities from view, where practical.	X	X		X	X		X	X
133. Operators would paint all aboveground production facilities with appropriate colors (e.g., Carlsbad Canyon or other environmental color required by BLM) to blend with adjacent terrain, except for structures that require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements.	X	X	X	X	X	X	X	X
134. Operators would implement the resource, mitigation, and monitoring measures found in the Transportation Plan (BLM 2004a). Annual transportation planning would occur in coordination with efforts required for the Pinedale Anticline Project (BLM 2000c) to identify the minimum road network necessary to support annually proposed project activities; Operator construction and maintenance responsibilities; and road-specific dust abatement, construction, and surfacing requirements.	X		X		X		X	X
135. Existing roads would be used to the maximum extent possible and upgraded as necessary.	X	X			X			X
136. All new and improved roads not required for routine operation and maintenance of producing wells or ancillary facilities would be reclaimed as directed by the BLM, State Land Board, or private landowner. These roads would be permanently blocked, recontoured, reclaimed, and revegetated by Operators, as would disturbed areas associated with permanently plugged and abandoned wells. Reclamation of existing two-track roads would be considered on a case-by-case basis.	X	X		X	X		X	X
137. Site-specific centerline survey and construction designs would be submitted to and approved by the BLM prior to road construction.	X	X		X	X		X	X
138. Operators would comply with existing federal, state, and county requirements and restrictions to protect road networks and the traveling public.	X	X	X	X	X	X	X	X
139. Special arrangements would be made with the Wyoming Department of Transportation (WDOT) to transport oversize loads to the project area. Otherwise, load limits would be observed at all times to prevent damage to existing road surfaces.	X	X	X	X	X	X	X	X

Exhibit B-1 (continued)

Mitigation/Monitoring/Development Measures	Proposed Action	A	B	C	D	E	F	G
140. All development activities along approved ROWs would be restricted to areas authorized in the approved ROW.	X	X	X	X	X	X	X	X
141. Available topsoil would be stripped from all road corridors prior to commencement of construction activities and would be redistributed and reseeded on backslope areas of the borrow ditch after completion of road construction activities. Borrow ditches would be reseeded in the first appropriate season after initial disturbance.	X	X	X	X	X	X	X	X
142. Operators would maximize the use of temporary fresh water pipelines during late spring, summer, and early fall from water wells to active drill sites to decrease water hauling needs.	X	X		X	X		X	X
143 . Operators would utilize WDEQ-approved portable sanitation facilities at drill sites.	X	X		X	X	X	X	X
144. Operators would place warning signs near hazardous areas and along roadways.	X	X			X			X
145. Operators would place dumpsters at each construction site to collect and store garbage and refuse.	X	X			X			X
146. Operators would ensure that all refuse and garbage is transported to a state-approved sanitary landfill for disposal.	X	X	X	X	X	X	X	X
147. Operators would institute a Hazard Communication Program for its employees and would require subcontractor programs in accordance with OSHA (29 C.F.R. 1910.1200).	X	X	X	X	X	X	X	X
148. In accordance with 29 C.F.R. 1910.1200, a Material Safety Data Sheet for every chemical or hazardous material brought on-site would be kept on file at the Operator's field office.	X	X	X	X	X	X	X	X
149. SPCCPs would be written and implemented in accordance with 40 C.F.R. 112.	X	X	X	X	X	X	X	X
150. Chemical and hazardous materials would be inventoried and reported in accordance with 40 C.F.R. 335. If quantities exceeding 10,000 pounds or the threshold planning quality are to be produced or stored, the appropriate Section 311 and 312 forms would be submitted at the required times to the State and County Emergency Management Coordinators and the local fire departments.	X	X	X	X	X	X	X	X
151. Any hazardous wastes, as defined by the *Resource Conservation and Recovery Act of 1976* (RCRA), as amended, would be transported and/or disposed of in accordance with all applicable federal, state, and local regulations.	X	X	X	X	X	X	X	X
152. Operators would adhere to existing internal health and safety policies and procedures.	X	X	X	X	X	X	X	X
153. Operators would not release fracturing fluids and condensates into flare pits or surrounding areas; they would be confined in the reserve pit or tanks. All reserve pits would be lined unless an exception is granted by the BLM.	X	X			X		X	X

APPENDIX C — SCOPING ISSUES AND CONCERNS

GENERAL ISSUES

- Consider Greater Yellowstone Coalition for guidance on future development.
- Oil and gas companies do not pay fair market value for leases: government should not subsidize this industry.
- Increase local awareness of the role of local government in the federal planning process.
- Directionally drilled wells should not be addressed in the NEPA analysis.
- Adhere to FLPMA.
- Ensure adherence with international principals and law using current ecological data.
- BLM will be open to lawsuits if the project proceeds.
- No pressing need for the development at this time.
- The project undercuts wildlife protection measures in the original EIS.
- Do not renew expired leases.
- Existing oil and gas leases in the area should be bought out and/or traded for leases in areas of less-sensitive natural resources.
- Do not waste taxpayer dollars on an EIS for this detrimental project.
- Do not permit drilling on private lands without surface landowner approval.
- BLM is taking a pro-oil-and-gas stance, as evidenced in the Heritage Brief of 2003.
- Include environmental protection as a purpose and need.
- BLM is not considering the Jonah Field for multiple use.
- BLM must abide by requirements to manage public lands for multiple use and sustained yield.
- The current average of 90 days to process and approve an APD is unacceptable and must be addressed to avoid interruption of development.

- Improve communication and include proponents in the NEPA process (including range of alternatives development) whenever possible, and facilitate and improve information exchange as recommended by the Green River Basin Advisory Council to reduce time frames and ensure analyses are objective, factual, and complete.

- BLM must remain on the sideline with respect to down-hole spacing issues, and take the forefront in encouraging efficient and rapid development of the resource to prevent waste.

- BLM must recognize their role as lead agency, must not be swayed by public pressure from "conflict industries," and must base their decisions on sound science and fact.

- Consider the April 3, 2003, Instruction Memorandum issued by the BLM regarding the need to protect surface owners on split estate properties.

- If the BLM has insufficient resources to engage in inspection and enforcement, the backlog of inspection, enforcement, and other related issues must be dealt with satisfactorily prior to allowing further development.

- BLM must inspect operations and enforce policy.

- Violations by oil and gas companies should be addressed and may be resolved by canceling the lease, as well as imposing civil and/or criminal penalties.

- The EIS should identify which stipulations cannot be relaxed and the specific conditions that must be met before a request to exempt, except, or relax a stipulation is allowed. Exemptions and exceptions should never be granted as a matter of convenience.

- The differences in stipulations between environmental documents in the same region should be justified considering the input by experts; any variability in stipulations should be recognized as legitimate by both BLM and WGFD before being implemented.

- Provide the public the opportunity to receive notice of individual APDs and participate in site-specific actions. The notice should be sent to groups/individuals requesting such notice within 3 business days of the day the application is received.

- Sufficient bonds must be provided as a part of each complete APD.

- BLM retains the authority to condition oil and gas development despite issuance of a lease, and they should exercise this mandate to avoid unnecessary and undue degradation of public lands.

- The EIS and ROD must ensure that the policies and goals set forth in the NEPA are met.

- The EIS and ROD should consider, analyze, and, where appropriate, facilitate international efforts to prevent environmental decline, as stated in 42 U.S.C. Section 4332, 40 C.F.R. Section 1507.2, and BLM Handbook H-1790-1.V.B.2.a(3).

- BLM must disclose how it has, since 1988, inventoried its lands and monitored natural resources and must reveal the data gathered.

- Address the adequacy of the NEPA process, in consideration of authorizations for the Jonah II Project without securing adequate information on environmental impacts of Jonah I.

- In accordance with Memorandum No. 99-149, issued to relevant BLM officials on July 1, 1999, assess whether existing NEPA documents can be relied upon for a current Proposed Action and, if so, assist personnel in recording the rationale for that conclusion.

- NEPA and the *Endangered Species Act* (ESA) prohibit drilling of additional wells in the JIDPA while this EIS is being prepared.

- The aggregate nature of BLM development reviews could adversely affect the State of Wyoming's ability to develop its mineral interests to avoid drainage.

- Interested parties should have available to them any data collected on air quality, habitat impacts, water quality, etc.

- The USFS should be a cooperator on the Jonah Infill project.

- BLM has the responsibility to ensure that local media report the issues from all perspectives. If media reporting is biased toward one or the other point of view, the BLM should write a letter to the editor to ensure the other side is heard.

- Incorporate EnCana advertisements in the public record and hold them responsible for the promises made in these ads.

- Follow EO 13212 in development of project-level NEPA analyses; current programs, policies, and rules must be evaluated to reduce barriers to America's energy self-sufficiency.

- Communicate with cooperating agencies to prevent unforeseen delays, acknowledge the responsibilities of the various agencies, and work with them during preparation of the NEPA document.

- Allow continued development of the Jonah Field under the existing NEPA analysis during the preparation of the new EIS at the same pace as has been realized for the past 3-5 years.

RMP ISSUES

- Postpone the environmental analysis of the Jonah Project until the PFO RMP has been revised and an ROD signed.

- Disclose to the public that this analysis will go forward independent from the PFO RMP.

- The existing RMP predates the latest technological advances in natural gas recovery.

- The existing RMP does not address the impacts from coalbed methane development, accelerated gas drilling, the increase in disturbance due to subdivisions, etc., over the past 10+ years and the concomitant decrease in wildlife habitat.

- Preparation of the PFO RMP must not take precedence or hinder the progress of the Jonah EIS.

- The PFO RMP should set forth strict inspection and enforcement guidelines, should require quarterly inspection of well sites, and should require at least one unannounced wellsite visit annually.

- Evaluating additional major oil and gas development projects while revising the RMP will limit the choice of the reasonable alternatives the agency might otherwise have available in the RMP, thus violating 40 C.F.R. Section 1506.1(a)(1)-(2) and 40 C.F.R. Section 1502.2(f).

- The existing RMP and Jonah NEPA documents are outdated and analyses are, for the most part, inadequate to allow tiering by the new Jonah EIS (e.g., the RMP-projected RFD has been exceeded to the point of nullifying its cumulative impacts analysis).

- Writing the EIS prior to completing the RMP predetermines the final outcome of the RMP, undermining the RMP process.

- The inadequacy of BLM's outdated and aging RMPs has opened the BLM up for litigation and has left the BLM ill-prepared to address areas with vulnerable, sensitive, or at-risk resources.

SCOPING ISSUES

- The scoping notice does not define time frames (e.g., initial disturbance, life of project).

- Explain and define the rules for public comment and the extent of the public's ability to affect the decision-making process.

- There is erroneous information in the scoping statement regarding the time span for exploring and developing the Jonah Field and the number of wells approved.

- A sufficient number of scoping meetings should be held at times and places that facilitate and encourage public participation and information. The meeting place and time should not be changed at the last minute, nor should the scoping meetings ever be held at an industry-sponsored location or event.

- Hold more public meetings before implementing the project.

- Some public concerns were not expressed at the scoping meeting because of intimidation due to the rally environment.

- Form letters and post card scoping comments should carry equal weight with other more detailed comments.

FIELD DEVELOPMENT ISSUES

- Directional drill from existing pads.
- Upgrade existing non-producing or low-quantity producing wells rather than drill new wells.
- Consider the use of alternative and innovative technologies.
- Wait until existing leases are finished, and return pads and roads to wilderness habitat before allowing new drilling.
- Restrict the pace of energy development and keep reserves for future use.
- Leave gas reserves in place if they cannot be accessed by directional drilling from existing pads.
- Maximize natural gas recovery.
- Maintain a lower density of wells and extend the expected 25-year life of the field.
- Use renewable energy sources whenever possible.
- Provide full NEPA disclosure and review of all industry practices in the EIS, designating a list of best practices for oil and gas development.
- Increased well productivity and the decreased need for roads, pipelines, etc., often compensates for increased directional drilling costs, resulting in more profitable operations.
- Well pad construction areas should be adequate for safe operations but be as small as possible.
- Incorporate suggested practices taken from *Drilling Smarter*.
- Consider removing the limit of 400 multiple well locations.
- Centralized condensate stabilization, storage/treatment, and produced water storage facilities should be promoted to help minimize disturbance acreage, traffic, and well site visits.
- Directional drilling should not be required as a primary reducer of disturbance.
- Require underground flaring.
- The complex area geology requires the denser well spacing pattern to ensure recovery of available gas reserves.
- The pipeline system should be located in road ROWs.

- The use of pit liners during the drilling of the wells may be unnecessary. The liner material may exist in a buried pit for 50 years or more.

ALTERNATIVES ISSUES

- Analyze the following alternatives: 1) no action; 2) no additional development until full reclamation of existing structures is achieved; 3) no new road construction (wells could be built along existing improved roads); and 4) directionally drill all new wells from existing well pads. If these alternatives are not considered, provide scientifically sound reasons why not.
- Evaluate a full development alternative and disclose how that will facilitate future Proposed Actions or necessary deviations from the approved alternative.
- A full development alternative should be developed to avoid re-analysis and project analysis piecemealing.
- A full development alternative should be included (i.e., nearly 3,000 additional wells on as little as 5-acre surface spacing).
- The EIS should contain objective analyses of feasible alternatives, not just mitigation techniques proposed on the presumption of significant impacts.
- Provide a broader range of alternatives to cover all possible levels of development.
- Include a resource protection alternative that includes mitigation measures (with clear and concise BLM and public enforcement capabilities) similar to but more stringent than the alternative adopted in the ROD for the Pinedale Anticline Natural Gas Project.
- Incorporate an alternative that withdraws any split estate lands from leasing if they have not yet been leased.
- BLM must not foreclose certain alternatives at the outset of the analysis; all reasonable alternatives must be rigorously explored and objectively evaluated.
- Use the scoping process to develop alternatives that emphasize the need for environmental protection (even if they limit or strongly regulate oil and gas development), rather than just accepting the highest level of industrialization as proposed by industry.
- Evaluate an alternative that requires use of best available technologies (e.g., recapturing gases rather than flaring) and directional drilling.
- Evaluate alternatives that propose development at several different total well numbers (i.e., include alternatives with lower levels of industrialization).
- Consider a conservation/community alternative with fewer wells (<1,250), a slower development pace (<75 wells/year), and no new well pads.

- Evaluate alternatives that propose several different configurations and well spacing scenarios; BLM has the discretion to depart from the industry-preferred configurations and well spacing.

- Consider alternatives that require off-site mitigation and require such mitigation in the ROD.

- Do not treat non-preferred alternatives as "straw men" whose only function is to provide "extremes" against which to contrast "moderate" alternatives.

IMPACT/CUMULATIVE IMPACT ISSUES

- There is not enough current information on the long-term and cumulative impacts of existing wells in the Jonah Field and throughout the Green River Valley.

- The Jonah Field has already been negatively impacted to an unreasonable degree by existing and ongoing development.

- The Proposed Action constitutes unnecessary and undue degradation under FLPMA.

- BLM lacks knowledge on the level of existing development (i.e., number of wells existing in the PFO and their impacts); thus, they are unable to provide this information to concerned citizens.

- Address only the germane concerns and identify and eliminate from further analysis/discussion issues that are not significant and/or that have been covered by prior environmental review.

- In the context of oil and gas development, "incremental step" consultation is of concern, and the EIS must address this issue. BLM must assist the USFWS in developing a fully informed understanding of the effects of the *entire* action, even if incremental step consultation is used.

- An ecosystem-wide impacts study should be completed before allowing any further development to proceed.

- Provide maps and/or tables depicting the extent of oil and gas leases, seismic exploration projects, etc., in the PFO and on adjacent lands as part of the evaluation of RFD.

- Disclose baseline data and conditions for important resources (e.g., air and water quality; wildlife populations, migrations, and habitat assessments) present in the area prior to development, and disclose the current ecological conditions of all resources to evaluate environmental conditions and impacts in an informed manner.

- Given the rate of development in the area, 1.2 million acres of the public lands that link the Greater Yellowstone Ecosystem could be converted to a single, continuous industrial sacrifice zone.

- Consider information in the report *Fragmenting Our Lands, the Ecological Footprint from Oil and Gas Development* (Weller et al. 2002).

- The cumulative effects analysis in the Jonah II documents are outdated (e.g., the Pinedale Anticline and numerous other oil and gas projects have occurred in the area since the analysis was conducted).

- Explicitly address unquantifiable environmental values (e.g., open space, quiet landscapes), defining the impacts of the various alternatives, as well as ways to mitigate for impacts on those values.

- Ground-truth and/or analyze with satellite imagery the true amount of surface disturbance associated with existing well pads, roads, compressor stations, pipelines, and other facilities and use those data (rather than the commonly used acreage assumptions) to estimate surface disturbance associated with the project.

- Gather information and disclose where information is lacking, and use credible, scientific evidence to present reasonably foreseeable adverse impacts (including low-likelihood but catastrophic events) so that impacts can be assessed based on approaches that are generally accepted in the scientific community.

- Disclose how actions on private lands (e.g., subdivisions, urban sprawl, roads, fences, and grazing), in combination with the project, would impact natural resources such as air, water, and wildlife.

- Consider connected actions, cumulative actions, and similar actions (40 C.F.R. Section 1508.25).

- Clarify how significant adverse impacts could be identified for the Pinedale Anticline Project, yet a FONSI could be reached in the adjacent Jonah II area in 2000.

MITIGATION/MONITORING ISSUES

- Exempt surrounding wilderness from any future drilling.

- Withdraw other areas from oil and gas leasing.

- Set aside or construct a mitigation project of equivalent benefit to resources other than oil and gas.

- Require strong monitoring programs for air and water quality, wildlife, etc.

- Industry should be compensated for mitigation costs above and beyond those required by current law (e.g., directional drilling); provide a cost/benefit analysis of all required mitigation measures.

- NEPA does not require mitigation for a FONSI.

- Take actions to prevent unnecessary or undue degradation of lands as required by FLPMA.

- Consider incorporating principles of adaptive management into the project, including 1) accurate delineation of critical habitats and corridors; 2) development of a relatively low number of wells, followed by an assessment of their effects through monitoring and research; and 3) based on these assessments, modify development and implement new mitigation measures.

- Mitigation discussions must have a prominent place and be a major part of the impact assessment process. BLM must consider a wide array of mitigation measures, including off-site measures, that lessen, and potentially eliminate, the adverse impacts of development on natural resources (e.g., water and air quality, wildlife).

- Provide a follow-up procedure to allow for the adoption of new best management practices, as they become available.

- BLM and Operators are legally mandated to monitor a number of species, but current monitoring has been inadequate to nonexistent, particularly for pronghorn antelope populations, distribution, and response to oil and gas development on the Pinedale Anticline project.

- Currently, the extent of the "reduced levels of development" outside the down-spacing area is not well defined, nor have the Operators relinquished the rights to explore/develop the area outside this area at a later date. The EIS should define a firmer commitment of what will occur outside of the proposed down-spacing area, so that more appropriate mitigation can be planned. At present, no further development is proposed for areas outside the JIDPA but within the formerly defined Jonah Field. In the event new development is proposed in this area, additional NEPA analysis would be conducted.

- The management problem of extending mitigation/protection measures to lands adjacent to the Jonah Project area that are within the Anticline Project area must be addressed.

- Off-site mitigation should not be analyzed since the JIDPA is within an Energy Policy and Conservation Act (EPCA) focus area.

LAND MANAGEMENT/USE ISSUES

- Density of disturbance may negatively impact recreation.

- The lands are more valuable for nonconsumptive (scenery, hunting, photography, camping, hiking, tourism) use than for the ultimately limited oil and gas reserves.

- The area of the project is remote, with a low population, little to no recreational value, and little to no agricultural value; thus, it is a desirable area to develop oil and gas reserves.

- Density of disturbance may negatively impact livestock grazing.

- The BLM is right in including disruption of livestock operations, loss of forage availability (short-term) and increased forage availability (long-term), and potential increased livestock productivity from increased water availability in scoping issues.

- Take a proactive approach to managing travel, roads, and off-road vehicle use within the project area.

- The approach at the Burma Road and Highway 351 junction is substandard and requires rebuilding to include widening, paving, and a new culvert and cattleguard.

- Limit habitat fragmentation, protect current roadless areas, provide for aggressively closing unnecessary or ecologically destructive roads, and provide for maintaining needed roads to reduce negative environmental impacts.

- The transportation plan must require adequate design considerations to minimize impacts (number and miles of roads) and provide orderly and safe traffic movement. The plan should include dust mitigation measures and siltation barriers, and the county should use tax revenues obtained from gas production to pave primary field access roads, similar to the policy of paving roads for energy development in Campbell County.

- If the project is approved, BLM should withdraw the South Piney Front from oil and gas leasing, present leases should be allowed to expire, and mitigation projects of equivalent benefit to other resources (e.g., wildlife habitat) should be constructed and implemented.

- Desired future conditions of the landscape must be addressed.

RECLAMATION/VEGETATION ISSUES

- Publicize locations that have been "successfully reclaimed" so that the public can see what the restored lands may look like.

- Reclaimed lands are often not blended into existing landscapes and, as a result, they are often used by all terrain vehicles (ATVs), resulting in lands that are not truly reclaimed back to an undisturbed state.

- It is a difficult and long-term prospect to reclaim desert lands after disturbance.

- The spread of non-native species as a result of the project must be addressed.

- The potential to remove 20% of the vegetation for the life-of-project (LOP) is a very significant vegetation impact, and noxious weed control, among other issues, must be addressed.

- Land may be damaged beyond its ability to be reclaimed.

- Provide for compliance and enforcement of *Executive Order* 13112, which establishes federal agency requirements and procedures relative to invasive species and requires agencies to not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species, unless it is determined that the benefits of such actions clearly outweigh the potential harm caused by invasive species.

- To protect native vegetation: 1) prohibit surface disturbance and ROWs in threatened, endangered, or sensitive plant species habitat; 2) ensure no cross-country vehicular travel is allowed in known habitat for sensitive plant species; 3) address how Operators will be trained with respect to noxious weed identification; 4) augment law enforcement personnel and field staff to curb noncompliance activities and to protect sensitive species from irreversible impacts; 5) survey the project area to document all relict or undisturbed plant communities and ensure that those areas are protected; 6) protect and reestablish, where degraded, riparian plant communities; 7) address how all equipment will be properly cleaned prior to arrival in the area; and 8) make every APD contingent on the prevention of weed infestation and include plans to monitor weed infestation over the LOP.

- Ensure that ecosystems are fully protected so as to enhance biological diversity.
- Sufficient bonds (as opposed to the unreasonably low bond amounts currently used) should be required to ensure adequate monies for cleanup/reclamation; this will protect the federal government, as well as landowners on split estates.
- Each APD should fully describe and detail reclamation requirements.
- Develop and implement practices to replace the grass resources lost to field development.
- Reclamation should proceed, as applicable, throughout the LOF so that final reclamation is more easily and quickly accomplished (e.g., controlling noxious weeds from the outset, rather than allowing them to propagate).
- Invite all interested parties to participate in final bond release inspections, and on split estate properties the landowners should be notified of the opportunity to participate at least 15 days prior to final inspection.

GENERAL WILDLIFE ISSUES

- Obtain better baseline wildlife data and monitoring (animals and habitat).
- The Jonah area is critical winter habitat for wildlife in the Yellowstone Ecosystem.
- Long-term impacts to pronghorn, greater sage-grouse, mountain plover, pygmy rabbit, and other high-profile or sensitive species are unknown and may be unacceptable.
- Prohibit development in environmentally sensitive areas such as big game migration corridors and winter and transitional ranges, greater sage-grouse strutting and nesting habitats, the Green and New Fork River corridors, and the scenic Wind River Front.
- Assess the impact on wildlife that are displaced and may move to less desirable or marginal habitat.
- The project will contribute to increased wildlife habitat fragmentation.
- Address impacts on wildlife deaths due to increased traffic and animal/vehicle collisions.
- Identify negative impacts of the road network on wildlife habitat, increased poaching, diminished enjoyment for hunters, visual impacts, and undue stress on wildlife during critical times of the year.
- Study and disclose the increase in poaching from increased human population size, access, and presence.

- Provide a list of species within and outside the PFO that will be impacted; disclose monitoring, population, and habitat data in regard to each species; and adopt mitigation measures to protect each species from negative impacts caused by the project.

- Discuss the impacts of the human population growth that accompanies oil and gas development on the wildlife species in and near the project area.

- The WGFD Strategic Habitat Plan should be closely followed and included within the project EIS and subsequent ROD.

- Indirect impacts of energy development on wildlife should be more extensively studied and incorporated into a long-term cumulative effects analysis, which also takes into account the subdivision of private lands in the Upper Green River Valley.

- Address the impact of power lines on birds and bats (e.g., strike hazard, electrocution, alteration of the structure of the habitat such as the provision of perches for raptors to the detriment of other species).

- Royalty revenues from natural gas and oil development underwrite the conservation of wildlife and habitat, national parks, refuges, and recreation areas and often fund research and monitoring efforts that assist land managers with managing the many resources found on public lands.

- Carefully analyze the potential impacts to migratory birds and require mitigations or avoidance accordingly.

- WGFD requests an opportunity to review existing wildlife monitoring data and to provide mitigation measures in coordination with BLM personnel.

- Water developments that provide year-round water sources for antelope and other wildlife species should be considered as mitigation--WGFD would provide on-the-ground consultation with Operators and BLM personnel to help implement this mitigation measure.

- Consider as mitigation the rejuvenation of the "wildlife wells" program in the Yellowpoint area.

- The disturbance of an additional 11,000 acres could pose a serious threat to wildlife habitat, causing habitat fragmentation and disruption of migration routes and breeding activity. Give serious thought and attention to cumulative impacts of this and other projects in the Green River Valley, with the importance of this area to many wildlife species, as well as tourism and recreation, weighing in heavily on the ultimate decision.

- Impacts to migratory birds must be addressed, actions that may result in a take of a bird or nest must be coordinated with USFWS, and the appropriate permits must be obtained prior to the actions.

- The field provides wildlife habitat, with facilities providing cover for small mammals, tanks and elevated structures providing nesting areas for birds, and new grass on reclaimed areas providing forage for ungulates. The short-term impact on wildlife should be weighed against the long-term improvement in their habitat.

BIG GAME ISSUES

- Assess wildlife impacts of winter drilling exceptions.

- Assess the impacts of the project on migration corridors of elk, deer, moose, and pronghorn.

- Impacts to deer and pronghorn may be subtle and not easily quantified but may include negative and incremental physiological responses, resulting in cumulative stress and less resistance to natural stressors (e.g., poor forage, climatic extremes).

- Consider the findings presented in *Potential Effects of Oil and Gas Development on Mule Deer and Pronghorn Populations in Western Wyoming* (Sawyer et al. 2001).

- The project may result in impacts on habitat use by deer and pronghorn, as well as the potential for alteration of use patterns resulting in degradation of winter, crucial, or transition ranges and use of marginal habitat.

- To protect migratory mammals: 1) no surface occupancy should be allowed in severe winter relief ranges for mule deer and pronghorn; 2) a minimum buffer zone of 200 meters should be used for wells and roads until ongoing studies are completed and recommendations based on study results can be made; 3) where possible, directional drilling should be required; and 4) pads should be placed to minimize disturbance to big game.

- Sufficient data should be collected so as to define the ecological and landscape conditions necessary for maintaining big game populations at WGFD target levels.

- Ensure that migration corridors and other ecological linkages are maintained and that management actions protect the ecological integrity of these corridors.

- Require no net loss of big game transitional and winter ranges.

- The Modified Jonah EA states that approximately 49% of the original Jonah II area would have reduced levels of development, and some areas may have no development. However, there were no assurances that these areas would not be further developed in the future. Desirable exploration and development areas may be identified as development proceeds in the area. If this is still true, the upper limit for impacts to migrating wildlife is unknown and cannot be adequately addressed. Impact levels should be identified that would trigger a re-analysis of impacts/alternatives in the future if further development occurs.

- The area provides wintering habitat for pronghorn, and the area west of the proposed down-spacing serves as a migration corridor for the Jackson Hole (and, presumably, other) antelope. Studies show that pronghorn appear to be wintering in areas not classified as winter range. Note that results of research to refine seasonal range boundaries will be provided as it becomes available.

- The reason for the mule deer population decline in the area may be that the deer are in a "down cycle," as has been described for deer in northwestern Wyoming.

- Consider the Western EcoSystems Technology Inc. (WEST) Evaluation of the PFO RMP and the Anticline Final EIS, including all materials referenced within (WEST 2003).

GREATER SAGE-GROUSE ISSUES

- Potential impacts to greater sage-grouse include 1) male and/or female lek attendance and the potential decrease in reproductive success; 2) disturbance of nesting and brooding greater sage-grouse and the resulting potential for decreased reproductive success; and 3) disturbance of wintering greater sage-grouse and the potential of forcing grouse onto less desirable wintering grounds, resulting in the potential for decreased survival and/or spring fitness.

- Thoroughly evaluate project impacts on greater sage-grouse and commit to the following: 1) adopt a policy of no surface disturbance within 3 miles of occupied leks; 2) locate and give special designation as Areas of Critical Environmental Concern (ACECs) to all areas used by greater sage-grouse during both average and severe winters; 3) require standard surveys as soon as possible to estimate changes in numbers of greater sage-grouse in identified winter use areas, to locate active leks, and to map mid- to late-summer brood-rearing areas based on moisture and green forage availability; 4) immediately initiate replicated, long-term studies to understand the effects of habitat fragmentation on predator numbers and greater sage-grouse predation rates; 5) incorporate the habitat guidelines/desired future conditions published by Connelly et al. (2000) into the project EIS/ROD so that greater sage-grouse nest success and chick survival improve; and 6) require road closures (permanent or seasonal), the burial of power lines, modifications of fences and other structures, and elimination of livestock grazing in areas where oil and gas production is permitted.

- The Western Association of Fish and Wildlife Agencies and the Wyoming BLM Statewide Greater Sage-grouse Team management guidelines should be utilized.

- Determine whether the grouse in the JIDPA are migratory.

- The distinction between active and historic greater sage-grouse leks should be addressed, and scientifically based rationale should be provided and other agency personnel (i.e., WGFD) input sought if protective stipulations are removed from historic leks.

- Avoidance of greater sage-grouse wintering areas should be addressed with specific details provided so that a disclosure of the benefits can be identified.

- Allowing down-spacing within the area and creating lower-density areas in the remainder of the Jonah Project Area would not benefit greater sage-grouse leks, as there are no longer any active leks outside of the proposed down-spacing area. To assure adequate protection for at least the nesting and brood-rearing habitat near project area lek sites, a 0.5-mi buffer around the 4-2, 4-6, and Sand Draw Reservoir leks should be provided for any new drilling sites. Additionally, a 0.5-mi buffer from new drilling should be afforded the Rocks, Buckhorn #1, Alkali Draw, and Shelter Cabin leks outside but adjacent to the JIDPA.

- The Jonah and Anticline areas provide fall and wintering range for greater sage-grouse that breed as far as 20-30 miles away. Alkali Draw and Granite Wash areas could be used as mitigation locations for potential impacts to winter range. Suggested mitigation/protection measures could be lower well densities, larger buffer zones for no surface disturbance, or both.

- No project activities that may exacerbate habitat loss or degradation for greater sage-grouse should be permitted in important habitats.

- Long-term monitoring efforts (20-30 years) and research studies to determine and separately quantify impacts of energy development and other multiple use activities are needed. It would also be desirable to establish concurrent long-term monitoring within the Wind River Front area, which is currently prohibited from new leasing.

- Unless site-specific information is available, greater sage-grouse habitat should be managed following the guidelines of Connelly et al. (2000), including 1) before initiating vegetative treatments, quantitatively evaluate the area proposed for treatment to ensure that it is not suitable breeding habitat (Generally, fire should not be used in greater sage-grouse breeding habitats dominated by Wyoming big sagebrush. Fire should also be avoided in areas prone to invasion by cheatgrass or other invasive weedy species.); 2) include sagebrush, native forbs (especially legumes), and native grasses in reseeding efforts; 3) when restoring habitats dominated by Wyoming big sagebrush, do not treat >20% of the breeding habitat within a 30-year period (Similarly, in areas dominated by mountain big sage, no more than 20% of the breeding habitat should be treated in a 20-year period.); 4) avoid land use practices that reduce soil moisture effectiveness, increase erosion, cause invasion of exotic plants, and reduce abundance and diversity of forbs; 5) avoid removing sagebrush within 300 m of greater sage-grouse foraging areas along riparian zones, meadow, lakebeds, and farmland, unless such removal is necessary to achieve management objectives; 6) avoid use of organophosphorus and carbamate insecticides in greater sage-grouse brood-rearing habitats; 7) avoid developing springs for livestock water, but if water from a spring will be used in a pipeline or trough, design the project to maintain free water and wet meadows in the spring; 8) maintain sagebrush communities on a landscape scale, allowing greater sage-grouse access to sagebrush stands with canopy cover or 10-30% and heights of 25-35 cm regardless of snow cover; 9) re-seed former winter ranges with the appropriate subspecies of sagebrush and herbaceous species unless the species are recolonizing the area in a density that would allow recovery within 15 years; 10) identify breeding and winter ranges in Wyoming big sagebrush habitats and establish these areas as high priority for wildfire suppression; and 11) greater sage-grouse populations that have thus far survived extensive habitat loss may still face extinction because of a time lag between habitat loss and population collapse.

- Incorporate recommendations in the report *A Review of Sage-Grouse Habitat Needs and Sage-Grouse Management Issues for the Revision of the BLM's Pinedale District Resource Management Plan* (Braun 2002) including 1) adopt a policy of no surface disturbance within 3 miles of occupied leks, as data clearly show negative impacts to greater sage-grouse at the present distance of 0.25 mile or 0.50 mile; 2) all areas used by greater sage-grouse during both average or "normal" and severe winters should be located, mapped, and given special protection from wildfire, manipulation of sagebrush, and human-induced disturbance (At least 90% of the newly mapped areas should be designated as a network of ACECs as part of the RMP revision process.); 3) adherence to time of use restrictions for project activities from 6:00 p.m. to 9:00 a.m. during the breeding and nesting periods should be strictly monitored and enforced; 4) management of mid- to late-summer brood-rearing areas should encourage forb regrowth while maintaining at least a 6-inch residual grass height with taller live sagebrush of >15% canopy cover in close proximity (<200 yards) for use as escape cover; and 5) mitigation should be emphasized for all activities known to negatively impact greater sage-grouse, including but not limited to a) burial or modification of power lines; b) offset drilling; c) road closures and time restrictions; d) removal of livestock grazing; e) nitrogen fertilization of winter and nesting areas; and f) removal or modification of existing fences. Full mitigation would be to replace the exact number of project-impacted grouse by increasing the number of grouse per area that unaffected areas can support.

RAPTOR ISSUES

- Examine existing stipulations and protections to determine their effectiveness and whether they should be modified to protect raptors.
- Evaluate whether habitat that could potentially be occupied by raptors (e.g., previously utilized nests) should receive protection to ensure the continued viability of raptors in the JIDPA.
- Consider all biological needs of raptors and develop suitable protections for all significant life stages of the birds.
- Address BLM means of compliance and enforcement with the *Bald Eagle Protection Act* and *Migratory Bird Treaty Act*.

THREATENED, ENDANGERED, PROPOSED, CANDIDATE AND BLM WYOMING SENSITIVE SPECIES

- Address threatened, endangered, proposed, and candidate (TEP&C) and BLM Wyoming sensitive (BWS) species.
- Work toward prairie dog conservation and recovery, and disclose whether any prairie dog towns are found in the JIDPA.
- Require and ensure full compliance with BLM Manual MS-6840, including the following: 1) ensure candidate and BWS species are appropriately considered; 2) develop and implement range-wide or site-specific management plans, conservation strategies, and assessments for TEP&C and BWS species that include specific habitat and population management strategies and objectives; 3) ensure activities affecting the habitat of TEP&C and BWS species are carried out in a manner consistent with management objectives; and 4) monitor populations and habitats of TEP&C and BWS species to determine whether management objectives are being met.
- Ensure full compliance with requirements to engage in early consultation with the USFWS relative to the effects of this action on listed species.

- Identify and provide for the protection of keystone species (e.g., prairie dogs), and recognize and protect keystone resources (e.g., springs, deep pools in streams, salt or mineral licks).

- Comply with the *Endangered Species Act* (ESA), and proactively implement programs for the conservation of listed species.

- Prepare a Biological Assessment (BA) and involve only credible and reputable scientists to conduct BA and other ESA-related analyses.

- It is inappropriate to merge BAs with EISs, mixing ESA compliance with NEPA compliance.

- Information on the existence of pygmy rabbits in the project area must be collected prior to activity associated with this proposed project, and pygmy rabbit habitat should be considered in APD decisions. BLM should immediately begin collecting pygmy rabbit data for the project, as well as assessing if Jonah Field management requires adjustment.

- Protection of potential TEP&C species habitat should not be given the same protection as that for TEP&C species.

- If the project is approved, BLM and their non-federal representatives must work with the USFWS to develop survey, impact minimization, and conservation measures for all listed species. Consultation with USFWS pursuant to Section 7(a)(2) of the ESA must be undertaken if the proposed project may affect a listed species.

- Species listed by USFWS that may be present in the project area or affected by the project include bald eagle, black-footed ferret, Ute ladies'-tresses, mountain plover, and Colorado River fish.

- Implement a 1.0-mi disturbance-free buffer around bald eagle nests and winter roosts, or, if not practical, activity must be conducted outside of February 15-August 15 to protect nesting birds and November 1-April 15 to protect roosting birds.

- If white-tailed prairie dog towns or complexes of greater than 200 acres will be disturbed, surveys for ferrets are recommended. These surveys should be conducted even if only a portion of the town or complex will be disturbed.

- Surveys for Ute ladies'-tresses should be conducted by a knowledgeable botanist trained in conducting rare plant surveys.

- Surveys for mountain plover should be conducted in all suitable nesting habitat, and nesting areas should be avoided from April 10 through July 10. The *Mountain Plover Survey Guidelines* provide the necessary information regarding surveys and protection measures. Changes in habitat suitability and/or direct habitat loss should also be addressed.

- Develop protective measures, with an assurance of implementation should mountain plover be found in the JIDPA.

- Formal consultation is required for any project that may lead to depletions of water to the Colorado River System. Depletions include evaporative losses and/or consumptive use of surface water or ground water within the affected basin. Should depletions be anticipated as a result of the project, include an estimate of the amount and timing (by month) of average annual water depletion (both existing and new depletions) and describe the methods of arriving at such estimates.

- The impacts to TEP&C species on non-federal lands must be considered an interrelated and interdependent effect and must be evaluated and addressed. Notify all lessees of their responsibilities to comply with federal and other applicable regulations, regardless of land or mineral ownership.

AIR QUALITY ISSUES

- Obtain better baseline air quality monitoring data before developing new wells.

- Air quality impacts may result in acidification of lakes, soil damage, and negative impacts to wildlife and human safety.

- The project is likely to result in significant air quality impacts not only in the JIDPA but also in the Class I Bridger and Fitzpatrick Wilderness Areas.

- The project is likely to result in the production and deposition of considerable volumes of oxides of sulfur (SOx), oxides of nitrogen (NOx), and other toxic aerosols; however, this deposition is extremely difficult to monitor due to the narrowness and shifting direction of the plumes.

- Address all reasonably foreseeable direct, indirect, and cumulative impacts on air quality, including global warming as a result of burning the produced gas.

- Air quality analysis for far-field effects should not be necessary, given the analysis completed for the Pinedale Anticline EIS.

- The air quality discussion should include a thorough analysis of the adverse impacts to air quality associated with burning substitute fuel sources, if development is limited, made more costly, or delayed.

- Include a complete increment consumption analysis to identify areas where Prevention of Significant Deterioration (PSD) increments have previously been fully consumed by prior development and/or will be fully consumed by the additional emissions from proposed oil and gas developments.

- Analyze control strategies to identify mitigation measures sufficient to prevent expected exceedances of air quality standards.

- Modeling should include emissions from drilling of 250 wells per year with emissions from the maximum number of producing wells.

- Analyze the recent evidence of adverse health effects associated with exposure to particulate matter less than 10 microns in size (PM10) and less than 2.5 microns in size (PM2.5).

- Address releases of hazardous air pollutants (HAPs) during produced water disposal operations.

- Implement cumulative impacts analysis including all completed, ongoing, and proposed oil and gas projects and other existing activities in the Greater Yellowstone Ecosystem.

- Quantify impacts state-wide.

- Consider mitigation measures sufficient to provide for compliance with state and federal standards and to prevent adverse effects: 1) on public health resulting from large increases in exposure to daily concentrations of fine particles and 2) on acid-sensitive watersheds as a result of emissions.

- Conduct a regulatory analysis to identify the minor source baseline dates for pollutants. If the EIS fails to include a comprehensive increment consumption analysis, the EIS will be rendered inadequate because without such analysis, it is impossible to determine whether increments have been consumed by prior development or whether the project will cause the increments to be exceeded.

- Before proceeding with the project, the RMP EIS must describe the full magnitude of the exceedances of increments that will result from adding emissions from the completed, ongoing, and proposed projects and then identify mitigation measures that will prevent the adverse impacts.

- Expressly address how the BLM will carry out responsibilities to protect visibility in the Class I areas.

- Include provisions to implement EPA's "No Degradations" policy under the *Clean Air Act*. The information needed to identify the least-impaired days and to provide a meaningful assessment of the extent to which visibility will be degraded on the least-impaired days should be developed and submitted to the public in the EIS. The results of the analysis should be considered for the purpose of identifying the kinds of mitigation measures necessary to achieve the No Degradation standard.

- Identify and mitigate acid rain impacts.

- Identify and mitigate the impacts on public health from fine particle exposures.

- Address the problem of global warming and the steps BLM can take in considering this project to reduce the problem.

- It is contended that 1) the Upper Green River Region has suffered measurable degradation from human-caused visual haze and nonvisible greenhouse gases (air transparency and possible regional microclimate/heating effects) from the trona plants west of Green River and drilling activities in the Jonah field; 2) distinct decreases in average peak ultraviolet radiation have resulted from the Jonah field; 3) haze events now occur in the region; and 4) there is increased traffic dust and engine emissions.

- Conduct investigations to assess microclimate heating prior to further development.

- Development and utilization of natural gas reserves assists in attainment of clean air objectives in conformance with presidential and congressional directives.

- Utilize NOx emissions data collected in recent years to determine whether visibility impacts are occurring or predicted to occur and use this information to make recommendations to EPA regarding air quality and to WDEQ regarding permitting for existing leases and in making decisions regarding future leases on BLM-administered lands.

- In light of the April 24, 2000, letter agreement between BLM, EPA, WDEQ, and the USFS to discontinue the Jonah II ROD levels of concern, the BLM should review the agreement, along with new monitoring information; should review emission sources that WDEQ has been tracking; and should assess current impacts and mitigation for future projects.

- Do not make the assumption that mitigation measures used in 40-, 80-, or 160-acre spacing are appropriate for the project. The proposed spacing will require additional analysis and mitigation practices that have not previously been required.

- EPA requests a meeting be set up as soon as possible, involving WDEQ, USFS, National Park Service (NPS), EPA, and BLM, to determine what has been accomplished (in the area of air and water quality) per past agreements for southwestern Wyoming and what future impact analysis and mitigation might be needed.

- Consider potential increased gas processing emissions associated with increased gas production from the field.

- Investigate options for off-site mitigation that may improve the overall air quality in southwest Wyoming while allowing development to continue (e.g., as when Ultra Petroleum and the Naughton Power Plant added emission reduction equipment to the Naughton Power Plant, reducing levels of NOx emissions).

- Cumulative impacts on air quality from the project combined with ongoing development and RFD, including the Powder River Basin Coalbed Methane Project, should be analyzed. Analysis should include potential impacts to visibility and deposition in the Bridger, Fitzpatrick, Teton, Washakie, and North Absaroka Wilderness Areas (Class I), as well as impacts to the Gros Ventre and Popo Agie Wilderness Areas (Class II).

- Air quality modeling domains should be expanded to incorporate the Powder River Basin study to determine cumulative impacts.

- The installation of vapor-burning stacks and other emissions control equipment in the field has increased the clarity of the air, which previously created a haze at the base of the Wind River Mountains east of the field.

WATER ISSUES

- Obtain better baseline water quality monitoring data before developing new wells.
- Assess present and future water quality, quantity, direction, and flow conditions.
- Pumping water from the Green and New Fork Rivers and their tributaries would magnify drought effects on these waters.
- Comply with WDEQ water quality permits/permitting requirements.
- The project will increase pollution and draining of water resources.
- Assess downstream effects on the Colorado River system.
- Two stock ponds have dried up and six cattle have been poisoned from drinking contaminated water as a result of oil and gas activities in the area.
- Concern over negative effects of aquifer depletion on stock ponds.
- Ensure compliance with the *Clean Water Act* and 1) manage natural resources on a watershed basis; 2) emphasize assessment of the function and condition of watersheds, incorporating watershed goals in planning, enhancing pollution prevention, monitoring and restoring watersheds, recognizing waters of exceptional value, and expanding collaboration with other agencies, states, tribes, and communities; 3) increase maintenance of roads and trails and aggressively relocate problem roads and trails; and 4) enhance the quality of streams and riparian zones and accelerate restoration.
- The proposed well density may cause problems with sediment in runoff from storm events, thus impacting water quality in the Green River.
- Water quality data should be logged and continually registered at the Sublette County Courthouse Register of Deeds and Documents prior to and during oil and gas development.
- Riparian or streamside habitats should be avoided whenever possible. Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The plan should also include a contingency plan to be implemented should the mitigation be unsuccessful.
- It may be advantageous for all parties to find a use for the produced water before it is evaporated or injected.
- Water handling equipment is currently being tested to investigate the viability of reusing produced water for base fluid in fracture simulations.

CULTURAL/ARCHAEOLOGICAL/HISTORIC RESOURCE ISSUES

- Assess impacts to Native American issues and cultural/religious sites.
- Assess impacts to National Historical Trails in light of recent legislation protecting those sites.
- Density of disturbance may negatively impact archaeological resources.
- Consider more intensive data collection on archaeological sites of high value in exchange for disturbance of areas with less unique archaeological value.
- Address the implication of the recent Instruction Memorandum authorizing the BLM to do away with the traditional linear approach to surveying for cultural resources on the Jonah area.
- Identify areas where cultural sites are at risk, and employ available administrative measures to protect those resources.
- Provide specific management intent and practices for cultural resources.
- Consult with Native American tribes during the planning process.
- Ensure that cultural resource inventories are prepared and maintained and that historic properties are identified, evaluated, and protected, and if appropriate nominated to the National Register of Historic Places (NRHP).
- The effects of the project on the Lander Trail should be addressed.
- Address the cumulative effects of the proposed development on cultural resources.
- BLM has not honored an agreement (Programmatic Agreement between the BLM and SHPO regarding the Jonah II and Pinedale Anticline) to develop a historic context planning document that would synthesize previous ethnohistorical, historical, geophysical, soils, biological, and cultural-historical studies conducted within the fields. This synthesis was to have been used to form the basis for development of a cultural resource research design/management plan, which was to have been completed within one year of ratification of the agreement.
- Given past failures to consult in good faith and to fulfill previous obligations, the BLM has not met its commitment to managing and protecting the important and nationally significant historic properties under their charge. BLM must provide specific management intent and practices with regard to cultural resource considerations and concerns identified by SHPO.

OTHER NATURAL RESOURCE ISSUES

- Soil surveys are needed in the area.
- Given the past several years of drought, recognize and address the potential for soil erosion from all proposed surface disturbance.
- The use of soils analysis is potentially beneficial, but the costs should not be born by Operators alone--tax revenues in the county should be used to finance the expenditure.
- Concern over effects on livestock and wildlife food sources.
- Address impacts to visual resources; density of disturbance may negatively impact visual resources.
- Address impacts from noise, including requirements to minimize noise and plans for monitoring.

HEALTH AND SAFETY ISSUES

- The oil and gas industry leaves behind equipment and contaminated soil and water.
- Address public health issues.
- Require the containment of litter and industrial waste.
- Include provisions to notify the public of health and safety threats.
- Address the use of hydraulic fracturing and the impacts of drilling fluids and chemicals on the environment.
- Drilling operations must be required to comply with any applicable stormwater discharge requirements, including acquiring National Pollutant Discharge Elimination System (NPDES) permits, as required.
- Work with the EPA relative to regulation of hazardous and toxic wastes generated from gas development activities.

SOCIOECONOMIC ISSUES

- Continue drilling at the present or accelerated rate to prevent expensive start up and shut down costs and continue current economic momentum.
- Retain current Operators who have experience in the Jonah Field.
- Provide a thorough socioeconomic analysis for each alternative considered.
- Avoid boom-bust cycles, which create pricing instability.

- The project would generate a large amount of taxes and royalties, much of which would be returned to state and county governments for use in education and other tax-funded programs.

- Consider not only Sublette County but also neighboring counties and communities.

- The amount of tax and royalty revenue generated from the project should be made public and consider distributions to schools, hospitals, roads, convalescent homes, and other infrastructures.

- Present the negative impacts associated with not developing the natural gas resources (e.g., loss of jobs, royalties, taxes, etc.).

- Natural and physical resources should not be given more credence and analysis than human (social and economic) factors.

- Models historically used for socioeconomic analysis do not adequately account for long-term trends associated with community stability.

- The project would help mitigate long-term trends of decreasing school enrollment and aging demographics.

- Development of the project would increase Wyoming's share of new and existing natural gas markets.

- The input-output models historically used in determining socioeconomics must take into account long-term trends associated with education.

- In considering economic factors, include loss of revenue to the WGFD and local outfitters because of declines in wildlife.

- Private industries should not profit from public lands.

- Concerns regarding a foreign (Canadian) company coming in and profiting from our mineral wealth and then leaving after destroying public lands.

- Consider the economic impacts (e.g., loss of tourism, hunting, fishing income) to the state as public lands of high recreational value are developed.

- Consider school enrollment declines/school closures (consolidations) in Sweetwater County.

- Consider long-term trends.

- Implementing the project as described would contribute to boom and bust economic conditions, rather than economic stability, as opposed to a phased approach requiring closure and reclamation prior to granting new permits, which would allow production on a sustainable level.

- In the long run, tourism dollars are more sustainable than oil and gas industry dollars.

- The oil and gas industry has caused skyrocketing property values and property taxes in the area.
- The high pay of transient oil and gas workers has raised the per capita and median income levels to the point where government grants previously available to fund community projects are no longer available.
- Natural gas prices have skyrocketed since local production of the resource was initiated.

MISCELLANEOUS ISSUES

- Work harder to develop alternative energy sources.
- Include provisions that ensure that industry is held accountable for the full liability of conducting business in the Upper Green River Valley.
- Cut demand and use less natural gas.
- Pursue alternate energy sources (e.g., wind power) instead of implementing the project.
- The project is necessary for National Security to develop the gas and keep Operators from moving to foreign countries.
- The project sets the precedent for similar high levels of energy development throughout the Green River Valley.
- Rapid destruction of wild places throughout Wyoming is undesirable
- Use previously generated data to expedite document preparation.
- Establish a time line and a project deadline if so requested by the Operator.
- The BLM should recognize its increased demand for manpower, and must act accordingly to adequately staff the PFO.
- The ROD should be issued by March of 2005.
- The BLM is already 5 months behind the schedule contained in the Memorandum of Understanding (MOU) and must strive to issue the ROD as soon as possible.
- An increase in demand is anticipated for natural gas as a clean, low-cost fuel.
- The BLM Reservoir Management Group (RMG) must provide analysis of the waste of reserves that will occur if all wells are required to be directionally drilled.
- The BLM must not use pace of development assumptions in its NEPA analysis as absolute ceilings on development.
- The WOGCC must be involved as a cooperating agent in the preparation of the EIS.

- Allow the development, but with more input from conservation groups and other federal agencies.

- The project provides a clean, environmentally desirable energy source.

- Regarding areas where the BLM lacks baseline data, describe how BLM intends to deal with this lack of data and how such data will be collected in the future.

- Further exploration prior to preparation of the EIS, as proposed by BLM in the Scoping Notice, would violate NEPA, further exceed the RFD scenario, and potentially violate the ESA; this exploration must not be allowed.

- BLM must not define the purpose and need solely as to allow natural gas production and cater to the oil and gas industry's desire to develop and produce resources; it must also include strong environmental protections as at least a co-equal purpose and need.

- Existing NEPA documents are outdated and must be supplemented before they can be used for tiering purposes and before any further drilling can occur.

- The Pinedale Anticline NEPA documents are outdated and must be supplemented before they can be used for tiering.

- Information should be presented in a manner that the public can easily understand.

- Consider oil and gas projects as long-term that pay over years (not boom and bust).

- The EIS should be based on new and current resource data.

- Provide a map showing the location of the JIDPA relative to other ongoing and proposed oil, gas, and coalbed methane projects. The status and extent of each development should be identified.

- Natural gas is the cleanest, most efficient fossil fuel and is used in many alternative energy sources such as fuel cells.

- Development over such a short time frame has very little environmental consequence in the greater scheme.

- The denser well spacing provides new jobs and creates less impact on the environment than development outside an existing gas field.

- The scope of the EIS should be limited and simple.

- Approximately 90% of the PFO is currently under lease and, including the Jonah Field, six major natural gas fields are in operation in the area.

APPENDIX D — A FRAMEWORK FOR ADAPTIVE MANAGEMENT IN THE JONAH INFILL DRILLING PROJECT AREA (JIDPA)

I. INTRODUCTION

The Bureau of Land Management (BLM) proposes to implement an adaptive management process in the Jonah Infill Drilling Project Area (JIDPA) which will generally follow the framework contained in this appendix. An interagency Jonah Infill Working Group (JIWG) would be established in the Jonah Infill Drilling Project Area (the Project) Record of Decision (ROD) to implement the process.

The potential value of adaptive management to the National Environmental Policy Act (NEPA) process is discussed by Carpenter (1997)[1] and is strongly supported by a number of agencies at the national level, including BLM, U.S. Environmental Protection Agency (EPA), and U.S. Department of Agriculture Forest Service (USFS). Carpenter summarized as follows: "*It is increasingly recognized that human interventions into natural systems seldom proceed as originally planned. Scientific uncertainties prevent environmental impacts from being reliably or precisely predicted. Thus, the style of management must provide for monitoring to guide mid-course corrections in adapting to inevitable surprises.*" Council on Environmental Quality (CEQ) NEPA regulations require continual monitoring.[2]

II. PURPOSE AND NEED

In addition to the uncertainties about how natural systems will react to human interventions, it has become apparent that current development guidelines and Conditions of Approval, and the restriction of 1 well pad/40 acres (16 well pads/640-ac section) authorized in the Modified Jonah Field II Project Area are not adequate protection for some JIDPA resources. However, national demand makes it imperative that as much natural gas as possible be recovered from the JIDPA. Project proponents are continually striving to develop drilling and production mitigation technologies to lessen the impacts of natural gas recovery, but those technologies are largely untested. There is uncertainty regarding the short- and long-term effectiveness of these new technologies, as well as uncertainty regarding the effectiveness of the mitigations and management restrictions BLM may place on infill development. These uncertainties require that a number of assumptions be used to predict the impacts associated with infill development; those assumptions may or may not be partially or wholly correct, which means the impact analysis may or may not be partially or wholly correct.

Uncertainty regarding the accuracy of the predictive assumptions and models used in the impact analysis, and uncertainty regarding how the environment will react to future development in the JIDPA using current and future un-tested development and mitigation technologies and un-tried restrictions, creates a need for a mechanism through which the BLM can make incremental adjustments to field management over time, as information is gained about how area resources are reacting to new technologies and/or restrictions. That mechanism is adaptive management.

The adaptive management process allows for changes in management without further NEPA analysis, unless designated thresholds are reached. The process increases the speed at which managers learn how resources react to their decisions and development activities, and thereby increases the speed at which managers can adjust mitigation and management restrictions for unanticipated impacts, or lack thereof. The adaptive management framework has several continuous steps: Decision is implemented; impacts are monitored; monitoring data is evaluated; modifications to mitigations or management restrictions are recommended, based on monitoring data; adaptive management decision is made and implemented; impacts are monitored; etc.

The purpose of this adaptive management process is to ensure that the impacts of development and production are monitored, and that the information from that monitoring is evaluated and fed back on a regular basis into the mitigation and management decisions that will be made following the Project decision. The purpose of the JIWG is to implement this adaptive management process in the JIDPA.

III. GOALS AND OBJECTIVES OF THE ADAPTIVE MANAGEMENT PROCESS

- Determine the effects of JIDPA development on area resources;
- Determine the effectiveness of the mitigation measures contained in the Project ROD;
- Modify the mitigation measures as deemed appropriate to achieve the stated goal/objective;
- Assure that oil and gas-related BLM decisions regarding the JIDPA are coordinated with non-oil-and-gas-related decisions (such as grazing, recreation, etc.);
- Provide a rapid response to unnecessary and undue environmental degradation;
- Validate predictive models used in the Project Environmental Impact Statement and revise the models/projections as necessary based on field observations and monitoring;
- Accurately monitor and predict cumulative impacts through BLM maintenance of a Geographic Information System (GIS) for the JIDPA including all activities (natural gas, agricultural, recreational, etc.) on federal and non-federal lands and how they are affecting area resources;
- Provide guidance for monitoring upon which the need to initiate Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) will be determined.

IV. IMPLEMENTATION MODEL

The BLM will implement and coordinate the adaptive management process. The BLM Pinedale Field Manager will accomplish that by establishing the interagency JIWG in the Project ROD.

The JIWG will function as an oversight working group consisting of one member each from BLM, USFWS, USFS, BLM, State of Wyoming, Sublette County, and the Sublette County Conservation District.

The JIWG will appoint subcommittees or Task Groups for key resources or as otherwise needed. Task Group membership will consist of agency technical experts for that resource.

The structure of the JIWG will be as shown in Figure D.1.

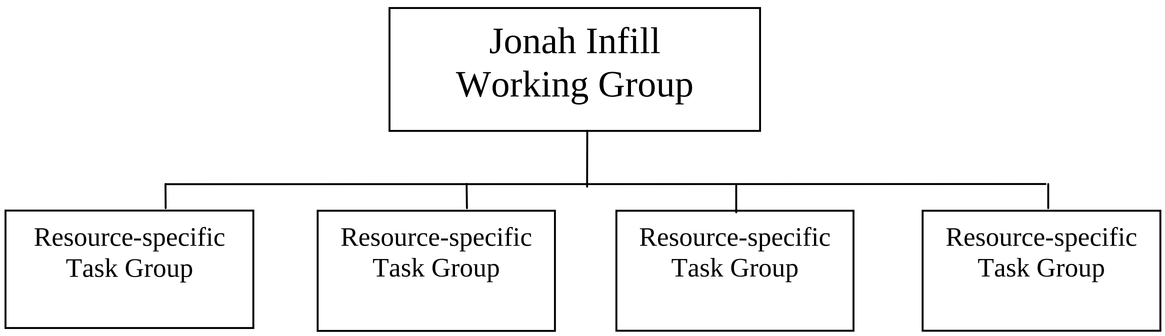

Figure D.1 Jonah Infill Working Group Structure

V. JIWG FUNCTIONS

The JIWG will meet in Pinedale within two months of the issuance of the Project ROD. The primary function of the JIWG will be to:

- Oversee the development and implementation of monitoring plans for resources within the JIDPA, for the life of the field, in part through appointment of resource-specific Task Groups as needed;

- Conduct at least an annual field inspection to review the implementation of construction, production, and reclamation operations;

- Review existing field conditions and learn about any new technologies or management restrictions;

- Review recommendations from the Task Groups and submit a synthesized recommendation to the BLM regarding monitoring, mitigations, and management prescriptions for the upcoming management period, and recommendations on who should do the monitoring and how the monitoring will be funded;

- Oversee implementation of monitoring;

- Meet at least once a year or more often as needed;

- Keep written record of meetings and disseminate to members.

VI. TASK GROUP FUNCTIONS

- Prepare and implement monitoring plans for resource(s) within the JIDPA for which the Task Group is responsible;

- Conduct at least an annual field inspection to review the implementation of construction, production, and/or reclamation operations as is appropriate for the resource for which the Task Group has responsibility;

- Review existing field and resource condition(s) and learn about any new technologies or management restrictions;

- Review and evaluate monitoring data;

- Synthesize monitoring information and upcoming development plans provided annually by the operators;

- Using that synthesis, make recommendations to the JIWG for the upcoming management period regarding monitoring, mitigation, management restrictions, who should implement the recommended monitoring, and identification of funding resources for the monitoring;

- Implement monitoring as directed by BLM;

- Meet as often as needed to fulfill responsibilities;

- Keep written record of meetings and disseminate to members and to the JIWG.

VII. JIWG AND TASK GROUP OPERATING PROCEDURES

- All JIWG and Task Group meetings will be open and available to the public and announced at least one week prior to the meetings via State-wide press releases.

- JIWG and Task Group leadership will develop meeting agendas to address the necessary items to fulfill the functions outlined above.

- All JIWG and Task Group decisions will be made by consensus.[3] If consensus on any point cannot be reached, the JIWG and/or BLM will be so notified. Such notification will include a brief description of the differing points of view and rationale.

- The JIWG and Task Groups will select their own leadership and scribes for whatever period of time each group deems appropriate.

- JIWG and Task Group meetings will be facilitated by the membership-selected leader unless the group chooses to request a qualified facilitator from BLM.

- The JIWG and Task Groups will make every effort to incorporate local and industry knowledge in their deliberations.

- The JIWG and Task Groups will make every effort to develop innovative funding sources for monitoring activities; such resources could include (but are not limited to) use of volunteers, seed money/matching funds, grants, etc. The JIWG and Task Groups will not depend solely on the JIDPA oil and gas Operators for funding.

- Other operating procedures may be developed as needed (such as media contacts), with JIWG and BLM concurrence.

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[1] Carpenter, R.A. 1997. The Case for Continuous Monitoring and Adaptive Management Under NEPA. In Environmental Policy and NEPA. R. Clark and L. Canter, eds. St. Lucie Press.

[2] CEQ regulations require appropriate application of continual monitoring and assessment. Section 102(2)(B) of NEPA calls for "*methods…which will insure that presently unquantified environmental amenities and values may be given appropriate consideration.*" CEQ regulations at 40 CFR 1505.2(c) and 1505.3(c) state, "*a monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation*" and that agencies "*may provide for monitoring to assure that their decisions are carried out and should do so in important cases.*" The lead agency must "*upon request, inform cooperating or commenting agencies on progress in carrying out mitigation measures which they have proposed and which were adopted by the agency making the decision,*" and, "*upon request, make available to the public the results of relevant monitoring.*"

[3] Consensus is defined as: all members (and their constituencies) "can live with" the decision; while a member or their constituency may not be 100% satisfied with the entire decision, the member and their constituency can and will support the group's decision.

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APPENDIX E — SUMMARY OF IMPACTS

Table E-1 Summary of Impacts Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E[2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F[2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G[2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE[2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
AIR QUALITY										
Increased concentrations of criteria pollutants and Hazardous Air Pollutants (HAPs)	No impact above existing levels; no new developments	Potential near-field concentrations would be in compliance with applicable National Ambient Air Quality Standards (NAAQS) and Wyoming Ambient Air Quality Standards (WAAQS); potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable Prevention of Significant Deterioration (PSD) increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments	Potential near-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be in compliance with applicable NAAQS and WAAQS; potential far-field concentrations would be below applicable PSD increments
Visibility (regional haze) at Class I and Sensitive Class II areas (far-field)	No impact above existing levels; no new developments	Potential project impacts would be greater than 1.0 deciview (dv) for a maximum of 10 days per year; impairment at Bridger Wilderness only	Potential project impacts would be greater than 1.0 dv for a maximum of 10 days per year; impairment at Bridger Wilderness only	Potential project impacts would be greater than 1.0 dv for a maximum of 11 days per year; impairment at Bridger Wilderness only	Potential project impacts would be greater than 1.0 dv for a maximum of 8 days per year; impairment at Bridger Wilderness only	Potential project impacts would be greater than for Alternative C and less than for Alternative A	Potential project impacts would be similar to Alternative B	Potential project impacts would be greater than 1.0 dv for a maximum of 11 days per year; impairment at Bridger Wilderness only	Potential project impacts would be greater than for Alternative A and less than for Alternative F	Potential project impacts would be similar to Alternative G
Visibility (regional haze) (mid-field communities)	No impact above existing levels; no new developments	Maximum of 23 days per year >1.0 dv	Maximum of 23 days per year >1.0 dv	Maximum of 26 days per year >1.0 dv	Maximum of 17 days per year >1.0 dv	Impacts greater than Alternative C but less than Alternative A	Impacts similar to Alternative B	Maximum of 24 days per year >1.0 dv	Impacts greater than Alternative A but less than Alternative F	Impacts similar to Alternative G
Atmospheric/terrestrial deposition	No impact above existing levels; no new developments	Potential project impacts from sulfur deposition would be less than Deposition Analysis Threshold (DAT) at all analyzed areas; potential project impacts from nitrogen deposition would be greater than DAT (i.e., 0.005 kg/ha/yr) at Bridger Wilderness (0.035 kg/ha/yr), Popo Agie Wilderness (0.065 kg/ha/yr), and Wind River Roadless Area (0.010 kg/ha/yr), and less than DAT at all other analyzed areas	Potential project impacts from sulfur deposition would be less than DAT at all analyzed areas; potential project impacts from nitrogen deposition would be greater than DAT (i.e., 0.005 kg/ha/yr) at Bridger Wilderness (0.035 kg/ha/yr), Popo Agie Wilderness (0.065 kg/ha/yr), and Wind River Roadless Area (0.010 kg/ha/yr), and less than DAT at all other analyzed areas	Potential project impacts from sulfur deposition would be less than DAT at all analyzed areas; potential project impacts from nitrogen deposition would be greater than DAT (i.e., 0.005 kg/ha/yr) at Bridger Wilderness (0.040 kg/ha/yr), Popo Agie Wilderness (0.019 kg/ha/yr), and Wind River Roadless Area (0.011 kg/ha/yr), and less than DAT at all other analyzed areas	Potential project impacts from sulfur deposition would be less than DAT at all analyzed areas; potential project impacts from nitrogen deposition would be greater than DAT (i.e., 0.005 kg/ha/yr) at Bridger Wilderness (0.032 kg/ha/yr), Popo Agie Wilderness (0.015 kg/ha/yr), and Wind River Roadless Area (0.009 kg/ha/yr), and less than DAT at all other analyzed areas	Potential project impacts from sulfur deposition would be less than DAT (i.e., 0.005 kg/ha/yr) at all analyzed areas; potential project impacts from nitrogen deposition would be greater than for Alternative C but less than for Alternative A	Potential project impacts would be similar to Alternative B	Potential project impacts from sulfur deposition would be less than DAT (i.e., 0.005 kg/ha/yr) at all analyzed areas; potential project impacts from nitrogen deposition would be greater than DAT at Bridger Wilderness (0.036 kg/ha/yr), Popo Agie Wilderness (0.017 kg/ha/yr), and Wind River Roadless Area (0.010 kg/ha/yr), and less than DAT at all other analyzed areas	Potential project impacts from sulfur deposition would be less than DAT (i.e., 0.005 kg/ha/yr) at all analyzed areas; potential project impacts from nitrogen deposition would be greater than for Alternative A but less than for Alternative F	Potential project impacts would be similar to Alternative G
Sensitive lake acid neutralization capacity (ANC)	No impact above existing levels; no new developments	Potential project impacts would be less than Limit of Acceptable Change (LAC); potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts would be less than LAC	Potential project impacts would be less than LAC; potential cumulative impacts were less than LAC
TOPOGRAPHY										
Landscape feature alteration	Total surface disturbance of 4,209 acres (1,409 acres Life-of-project [LOP]); duration of impact would be 63 years; no major landscape feature alterations	Total surface disturbance of 16,200 acres (4,631acres LOP) of additional surface disturbance; duration of impacts increased to 76 years	Total surface disturbance of 16,200 acres (4,631 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 3,297 acres (1,213 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 6,705 acres (1,990 acres LOP) of additional surface disturbance; duration of impacts increased to 68-80 years	Total surface disturbance of 11,581 acres (3,346 acres LOP) of additional surface disturbance; duration of impacts increased to 72-93 years	Total surface disturbance of 6,386 acres (2,188 acres LOP) of additional disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 10,446 acres (2,588 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 13,989 acres (3,999 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 7,804 acres (2,295 acres LOP) of additional surface disturbance; duration of impacts increased to 76-years
MINERAL RESOURCES										
Natural gas	3.37 trillion cubic ft (TCF) of gas recovered	7.95 TCF of gas recovered	8.19 TCF of gas recovered	6.12 TCF gas recovered	6.66 TCF of gas recovered	7.55 TCF of gas recovered	6.30 TCF of gas recovered	7.19 TCF of gas recovered	7.88 TCF of gas recovered	7.88 TCF of gas recovered
Oil (condensate)	32.0 million barrels of oil (MBO) recovered	75.5 MBO recovered	77.8 MBO recovered	58.2 MBO recovered	63.2 MBO recovered	71.8 MBO recovered	59.9 MBO recovered	68.3 MBO recovered	74.8 MBO recovered	74.8 MBO recovered

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
Other minerals	Localized LOP loss of access but no known minerals available in minable quantities; violation of contractual agreements	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76-105 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76-105 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 68-80 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 72-93 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76-105 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76-105 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76-105 years	Increased loss of access above No Action and no violation of contractual agreements; duration of impacts increased to 76 years
GEOLOGIC HAZARDS										
Earthquake damage	No impacts likely; low earthquake potential	Same as No Action	Same as No Action	Same as No Action	Same as No Action	Same as No Action	Same as No Action	Same as No Action	Same as No Action	Same as No Action
Landslides and slumping	No impacts likely; no known landslide areas or underground mines; no new facilities developed	Increased above No Action in some areas; duration of impacts increased to 76 years	Increased above No Action in some areas; duration of impacts increased to 76-105 years	Increased above No Action at project feature sites; duration of impacts increased to 76-105 years	Increased above No Action in some areas; duration of impacts increased to 68-80 years	Increased above No Action in some areas; duration of impacts increased to 72-93 years	Increased above No Action in some areas; duration of impacts increased to 76-105 years	Increased above No Action in some areas; duration of impacts increased to 76-105 years	Increased above No Action in some areas; duration of impacts increased to 76-105 years	Increased above No Action in some areas;increased mitigative actions; duration of impacts increased to 76 years
PALEONTOLOGICAL RESOURCES										
Disturbance/loss of important fossils during construction	Total surface disturbance of 4,209 acres (1,409 acres LOP); duration of impact would be 63 years; no major landscape feature alterations	Total surface disturbance of 16,200 acres (4,631 acres LOP) of additional surface disturbance; duration of impacts increased to 76 years	Total surface disturbance of 16,200 acres (4,631 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 3,297 acres (1,213 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 6,705 acres (1,990 acres LOP) of additional surface disturbance; duration of impacts increased to 68-80 years	Total surface disturbance of 11,581 acres (3,346 acres LOP) of additional surface disturbance; duration of impacts increased to 72-93 years	Total surface disturbance of 6,386 acres (2,188 acres LOP) of additional disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 10,446 acres (2,588 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 13,989 acres (3,999 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 7,804 acres (2,295 acres LOP) of additional surface disturbance; duration of impacts increased to 76 years
Fossil collection/vandalism for LOP	Total surface disturbance of 4,209 acres (1,409 acres LOP); duration of impact would be 63 years; no major landscape feature alterations	Total surface disturbance of 16,200 acres (4,631 acres LOP) of additional surface disturbance; duration of impacts increased to 76 years	Total surface disturbance of 16,200 acres (4,631 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 3,297 acres (1,213 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 6,705 acres (1,990 acres LOP) of additional surface disturbance; duration of impacts increased to 68-80 years	Total surface disturbance of 11,581 acres (3,346 acres LOP) of additional surface disturbance; duration of impacts increased to 72-93 years	Total surface disturbance of 6,386 acres (2,188 acres LOP) of additional disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 10,446 acres (2,588 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 13,989 acres (3,999 acres LOP) of additional surface disturbance; duration of impacts increased to 76-105 years	Total surface disturbance of 7,804 acres (2,295 acres LOP) of additional surface disturbance; duration of impacts increased to 76 years
SOILS										
Disturbance and erosional loss of soils; soil compaction and mixing of soil horizons; decreased topsoil productivity	Surface disturbance of 4,209 acres is currently authorized; no further surface disturbance would be authorized	Increase of 16,200 acres of new initial surface disturbance above No Action; duration of impacts increased to 76 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 3,297 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 6,705 acres of new initial surface disturbance above No Action; duration of impacts increased to 68-80 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 11,581 acres of new initial surface disturbance above No Action; duration of impacts increased to 72-93 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 6,386 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 10,446 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 13,989 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 7,804 acres of new initial surface disturbance above No Action; duration of impacts increased to 76 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Contamination due to accidental hazardous material discharge	No new facilities developed; decreased probability of impact	Adherence to Spill Prevention, Control, and Countermeasures Plans (SPCCPs), Storm Water Pollution Prevention Plans (SWPPPs,) and other applicable local, state, and federal rules and regulations; duration of impacts increased to 76 years; prompt soil remediation to minimize potential impact severity	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; duration of impacts increased to 76-105 years; prompt soil remediation to minimize potential impact severity	Increase of 3,297 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; prompt soil remediation to minimize potential impact severity	Increase of 6,705 acres of new initial surface disturbance above No Action; duration of impacts increased to 68-80 years; prompt soil remediation to minimize potential impact severity	Increase of 11,581 acres of new initial surface disturbance above No Action; duration of impacts increased to 72-93 years; prompt soil remediation to minimize potential impact severity	Increase of 6,386 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; prompt soil remediation to minimize potential impact severity	Increase of 10,446 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; prompt soil remediation to minimize potential impact severity	Increase of 13,989 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; prompt soil remediation to minimize potential impact severity	Increase of 7,804 acres of new initial surface disturbance above No Action; duration of impacts increased to 76 years; prompt soil remediation to minimize potential impact severity; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
Reactivation of stabilized dunes	No new surface disturbance of stabilized dunes	LOP potential until disturbed areas are reclaimed; 38 acres of known stabilized dunes occur within JIDPA	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 3,297 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 6,705 acres of new initial surface disturbance above No Action; duration of impacts increased to 68-80 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 11,581 acres of new initial surface disturbance above No Action; duration of impacts increased to 72-93 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 6,386 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 10,446 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 13,989 acres of new initial surface disturbance above No Action; duration of impacts increased to 76-105 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Increase of 7,804 acres of new initial surface disturbance above No Action; duration of impacts increased to 76 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
SURFACE WATER RESOURCES										
Increased turbidity, salinity, and sedimentation of surface waters due to runoff from disturbed areas	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; no natural perennial surface waters in the JIDPA	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Contamination of surface waters from accidental hazardous material discharge	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years; no new facilities developed; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations; prompt remediation to minimize potential impact severity	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Contamination of surface waters from discharge of unsuitable quality produced water and/or pipeline test water	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years; no new pipelines developed; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations; prompt remediation to minimize potential impact severity	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Alteration of surface drainages for LOP	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years; no new drainage crossings; adherence to SPCCPs , SWPPPs, and other applicable local, state, and federal rules; prompt remediation to minimize potential impact severity	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; no long-term modification of drainages	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
Flood damage to pipelines and facilities for LOP	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years; adherence to SPCCPs , SWPPPs, and other applicable local, state, and federal rules; prompt remediation to minimize potential impact severity; no new project facilities other than what are authorized under the Record of Decision (ROD)	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; few flood-prone areas in the JIDPA	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
GROUND WATER RESOURCES										
Depletion during development	No new consumption of ground water; full recovery of aquifer within a few years	Consumption of 1,225.0 acre-ft/year; 6.0 years to full recovery of aquifer; duration of impact would be 12 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 12-42 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 12-42 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 5-17 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 9-29 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 12-42 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 12-42 years and until aquifer recovery	Consumption of ground water at 367.5 to 1,225.0 acre-ft/year; 0.5 to 6.0 years to full recovery; duration of impacts would be 12-42 years and until aquifer recovery	Consumption of 1,225.0 acre-ft/year; 6.0 years to full aquifer recovery; duration of impacts would be 12 years and until aquifer recovery
Contamination of ground water from accidental hazardous material discharge and cross contamination in well bores	Adherence to SPCCPs, WOGCC, Bureau of Land Management (BLM) well casing and abandonment procedures, and other applicable local, state, and federal rules and regulations would minimize potential impact severity; no new development	Increased above No Action because new wells would be drilled; duration of impacts would be 76 years	Same as Proposed Action but increased in some areas that would have been avoided under the Proposed Action would be drilled; duration of impacts would be 76-105 years	Increased above No Action because new wells would be drilled; duration of impacts would be 76-105 years	Increased above No Action because new wells would be drilled; duration of impacts would be 68-80 years	Increased above No Action because new wells would be drilled; duration of impacts would be 72-93 years	Increased above No Action because new wells would be drilled; duration of impacts would be 76-105 years	Increased above No Action because new wells would be drilled; duration of impacts would be 76-105 years	Increased above No Action because new wells would be drilled; duration of impacts would be 76-105 years	Increased above No Action because new wells would be drilled; duration of impacts would be 76 years; impacts reduced due to application of specific mitigation measures
NOISE AND ODOR										
Increased noise levels near wells, facilities, and roads for LOP	Noise levels would not be increased above existing authorized actions (i.e., 533 wells on 497 well pads); LOP for authorized actions would be 63 years; although impacts were determined not significant during analysis of currently authorized actions, subsequent monitoring data indicate that existing noise levels likely are causing significant impacts	Noise levels higher than described for No Action as a result of new well pads, wells, and other project facilities proposed; noise associated with construction and drilling activities would be short-term, but that associated with field traffic and well maintenance would occur for 13 years longer than under No Action; impacts significant	Noise levels similar to those described for Proposed Action as a result of new well pads, wells, and other project facilities proposed; impacts to wildlife would increase in areas that would have been avoided under the Proposed Action; noise associated with construction and drilling activities would be short-term, but that associated with field traffic and well maintenance would occur for 13-42 years longer than under No Action; impacts significant	Noise levels similar to those described for Proposed Action as a result of new well pads, wells, and other project facilities proposed, but noise would be concentrated at existing pads; noise associated with construction and drilling activities would be short-term, but that associated with field traffic and well maintenance would occur for 13-42 years longer than under No Action; impacts significant	Noise levels higher than described for No Action but lower than for Proposed Action (60% fewer proposed well pads and wells); noise associated with construction and drilling activities would be short-term, but that associated with field traffic and well maintenance would occur for 5-17 years longer than under No Action; impacts significant	Noise levels higher than described for No Action but lower than for Proposed Action (29% fewer proposed well pads and wells); noise associated with construction and drilling activities would be short-term, but that associated with field traffic and well maintenance would occur for 9-30 years longer than under No Action; impacts significant	Noise levels higher than described for No Action as a result of 3,100 new wells, 266 new pads, and other project facilities proposed; per well and per pad duration of noise associated with construction and drilling activities would increase as a result of directional drilling, and noise associated with field traffic and well maintenance would occur for 13-42 years longer than under No Action; impacts significant	Noise levels higher than described for No Action as a result of 3,100 new wells, 1,028 new pads, and other project facilities proposed; per well and per pad duration of noise associated with construction and drilling activities would increase somewhat as a result of directional drilling, and noise associated with field traffic and well maintenance would occur for 13-42 years longer than under No Action; impacts significant	Noise levels higher than described for No Action as a result of 3,100 new wells, 2,553 new pads, and other project facilities proposed; per well and per pad duration of noise associated with construction and drilling activities would increase slightly as a result of directional drilling, and noise associated with field traffic and well maintenance would occur for 13-42 years longer than under No Action; impacts significant	Noise levels higher than as described for No Action as a result of new well pads, wells, and other project facilities proposed, but potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; noise associated with field traffic and well maintenance would occur for 13 years longer than under No Action; impacts significant
Presence of offensive odors near wells, facilities, and roads for LOP	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; LOP would be 63 years as authorized; no additional development	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; LOP extended by 13 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; increased impacts in areas that would have been avoided under Proposed Action; LOP extended by 13-42 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; development foci would be limited to existing well pads; LOP extended by 13-42 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; intermediate level of impacts between No Action and Proposed Action; LOP extended by 5-17 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; intermediate level of impacts between No Action and Proposed Action; LOP extended by 9-30 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; intermediate level of impacts between No Action and Proposed Action; LOP extended by 13-42 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; intermediate level of impacts between No Action and Proposed Action; LOP extended by 13-42 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; intermediate level of impacts between No Action and Proposed Action; LOP extended by 13-42 years over No Action	Temporary, localized impacts rapidly dispersed by wind; decreased after development completed; intermediate level of impacts between No Action and Proposed Action; LOP extended by 13 years over No Action

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
VEGETATION INCLUDING BWS PLANT SPECIES										
Loss of vegetation; changes in diversity following reclamation (i.e., shrubland to grassland); and potential weed infestation for LOP and until areas adequately reclaimed	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years plus time needed for adequate reclamation; no new surface disturbance beyond that currently authorized	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Same as Proposed Action (total surface disturbance of 20,409 acres [6,040 acres LOP] vs. 4,209 acres [1,409 acres LOP] under No Action) but possibly increased in areas that would have been avoided by the Proposed Action; LOP extended approximately 13-42 years from No Action; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Disturbance of wetlands and riparian areas for LOP	No new wetland disturbance	All wetlands would be avoided; 47 acres of wetlands in JIDPA	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended approximately 13-42 years over No Action	All wetlands would be avoided	All wetlands would be avoided	All wetlands would be avoided	All wetlands would be avoided	All wetlands would be avoided	All wetlands would be avoided	All wetlands would be avoided
Unsuccessful reclamation for LOP and beyond	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years plus time needed for adequate reclamation; no new surface disturbance beyond that currently authorized	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Same as Proposed Action (total surface disturbance of 20,409 acres [6,040 acres LOP] vs. 4,209 acres [1,409 acres LOP] under No Action) but possibly increased in areas that would have been avoided by the Proposed Action; LOP extended approximately 13-42 years over No Action; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Direct BWS plant habitat loss	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years plus time needed for adequate reclamation; no new surface disturbance beyond that currently authorized	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; adherence to site-specific surveys for BWS species would limit potential impact severity	Same as Proposed Action (total surface disturbance of 20,409 acres [6,040 acres LOP] vs. 4,209 acres [1,409 acres LOP] under No Action) but possibly increased in areas that would have been avoided by the Proposed Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; adherence to Reclamation Plan would mitigate, to some degree, potential severity of adverse impacts due to vegetation loss; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
WILDLIFE INCLUDING BWS ANIMAL SPECIES										
Direct habitat loss	Total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years plus time needed for adequate reclamation; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; selected Operator-committed and BLM-required practices (e.g., protection of raptor nests, sage grouse leks, and Sand Draw drainage corridor) would not occur; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to wildlife and BWS species and their habitat would be locally significant	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; impacts to wildlife and BWS species and their habitat would be locally significant
Increased mortality	Unquantified mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons, as a result of previously authorized actions; no new actions would be authorized under this alternative	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; LOP extended approximately 13 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; although disturbance acreage would be the same as under the Proposed Action, impacts would be further increased in some areas that would have been avoided under the Proposed Action (i.e., Sand Draw, raptor nest and sage grouse lek vicinities); LOP extended approximately 13-42 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; level of impacts would be greater than those under the No Action Alternative, but less than those under the Preferred Alternative because no new pads would be constructed; LOP extended approximately 13-42 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; level of impacts would be greater than those under the No Action Alternative, but less than those under the Preferred Alternative because 1,850 fewer wells would be drilled; LOP extended approximately 5-17 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; level of impacts would be greater than those under the No Action Alternative, and may be similar to those under the Preferred Alternative; LOP extended approximately 9-30 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; level of impacts would be greater than those under the No Action Alternative, and may be similar to slightly less than those under the Preferred Alternative because fewer pads are likely to be constructed; LOP extended approximately 13-42 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; level of impacts would be greater than those under the No Action Alternative, and may be similar to those under the Preferred Alternative; LOP extended approximately 13-42 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; level of impacts would be greater than those under the No Action Alternative, but probably more than those under the Preferred Alternative; LOP extended approximately 13-42 years over No Action	Unquantified increase in mortality related to vehicle/animal collisions, construction, and potential stress-related deaths, especially during critical seasons; LOP extended approximately 13 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Displacement; indirect habitat loss; habitat fragmentation	Human activity would displace some species from areas near project features, which, when coupled with direct habitat loss, would further fragment habitats; displacement would cause increased use of other habitats in the region; LOP for currently authorized actions would be 63 years; 87.4% of the JIDPA would be within 0.25 mile of project features; no new actions would be authorized under the proposed project	Same types of impacts as under No Action, but degree greatly increased and LOP extended approximately 13-42 years; habitat fragmentation probably most similar to Alternative G	Degree greatly increased above No Action and LOP extended approximately 13-42 years; habitat fragmentation probably most similar to Alternative G; impacts would be further increased in some areas that would have been avoided under the Proposed Action (i.e., Sand Draw, raptor nest and sage grouse lek vicinities)	Degree somewhat increased above No Action and LOP extended approximately 13-42 years; habitat fragmentation would be somewhat increased from the No Action Alternative	Degree somewhat increased above No Action and LOP extended approximately 5-17 years; habitat fragmentation would be somewhat increased from the No Action Alternative	Degree greatly increased above No Action and LOP extended approximately 9-30 years; habitat fragmentation probably most similar to Alternative G	Degree greatly increased above No Action and LOP extended approximately 13-42 years; 99.8% of the JIDPA would be within 0.25 mile and 97.3% of the JIDPA would be within 0.125 mile of project features	Degree greatly increased above No Action and LOP extended approximately 13-42 years; 99.96% of the JIDPA would be within 0.25 mile and 99.0% of the JIDPA would be within 0.125 mile of project features	Degree greatly increased above No Action and LOP extended approximately 13-42 years; 99.98% of the JIDPA would be within 0.25 mile and 99.2% of the JIDPA would be within 0.125 mile of project features	Degree greatly increased above No Action and LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; habitat fragmentation would increase, with the degree dependent on the location and arrangement of project facilities within the field
Alteration of pronghorn migration routes	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be 63 years for currently authorized actions	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13-42 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13-42 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13-42 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 5-17 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 9-30 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13-42 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13-42 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13-42 years from the No Action Alternative	Potential avoidance of the JIDPA by migrating pronghorn; relatively undisturbed areas remain west of the JIDPA; project disturbances unlikely to block or prohibit migration to and from crucial ranges; LOP would be extended approximately 13 years from the No Action Alternative

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
Loss of greater sage-grouse productivity for LOP	Loss of breeding, nesting, and winter habitat due to surface disturbance, noise, traffic, and human presence; total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years plus time needed for adequate reclamation; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; selected Operator-committed and BLM-required practices would not occur, thus further increasing potential negative impacts to sage-grouse; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years; impacts to greater sage grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to greater sage-grouse and their habitat would be significant	Types of impacts to greater sage-grouse similar to those under the No Action Alternative, but total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; impacts to greater sage-grouse and their habitat would be significant
Loss of raptor productivity for LOP	Fewer nesting initiations, nest site abandonment, and reproductive failure or decreased productivity due to increased human activity, habitat loss, and loss of prey base as a result of surface disturbance, noise, traffic, and human presence; total surface disturbance of 4,209 acres (1,409 acres LOP) currently authorized; LOP 63 years plus time needed for adequate reclamation; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; selected Operator-committed and BLM-required practices would not occur, thus further increasing potential negative impacts to nesting raptors; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 5-17 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 9-30 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13-42 years; impacts to raptors and their habitat would be locally significant	Types of impacts to raptors similar to those under the No Action Alternative, but total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 acres LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; impacts to raptors and their habitat would be locally significant
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE (TEP&C) SPECIES										
Direct habitat loss for LOP	Total surface disturbance of 4,209 acres (1,409 acres LOP); LOP of 63 years as authorized; no new disturbance or facilities; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 20,409 acres (6,040 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13-42 years; selected Operator-committed and BLM-required practices would not occur; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 7,506 acres (2,622 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13-42 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 10,914 acres (3,399 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 5-17 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 15,790 acres (4,755 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 9-30 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 10,595 acres (3,597 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13-42 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 14,655 acres (3,997 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13-42 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 18,198 acres (5,408 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13-42 years; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species	Total surface disturbance of 12,013 acres (3,704 acres LOP) vs. 4,209 acres (1,409 LOP) under No Action; LOP extended approximately 13 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; impacts to TEP&C species and their habitat would be minimal because of infrequent use of the area by TEP&C species
Displacement for LOP	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species; no new disturbance	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; some decrease in available habitat and habitat function for some species

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
Increased mortality for LOP	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no new facility sites	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal
Disturbance of critical habitats for LOP	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present; no new disturbance affected	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present	No adverse effects - no bald eagle nests or roosts; no confirmed black-footed ferret presence; no Ute ladies'-tresses habitat or known occurrence; no surface water withdrawal; no critical habitat present
WILD HORSES										
Loss of habitat; displacement; mortality	No impacts above existing levels; no new surface disturbance	2,415 acres new initial disturbance (715 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	867 acres new initial disturbance (305 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 13-42 years over No Action	1,276 acres new initial disturbance (398 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 5-17 years over No Action	1,861 acres new initial disturbance (561 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 9-30 years over No Action	1,237 acres new initial disturbance (422 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 13-42 years over No Action	1,725 acres new initial disturbance (470 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 13-42 years over No Action	2,150 acres new initial disturbance (639 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 13-42 years over No Action	1,408 new initial disturbance (435 acres LOP) within Wild Horse Herd Management Area; displacement due to human presence; potential vehicle/animal collisions; more areas with human presence; increased traffic; LOP extended 13 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
CULTURAL RESOURCES										
Disturbance/destruction of important sites	Potential impacts assumed to increase with increased surface disturbance; total surface disturbance 4,209 acres; no new surface disturbance	Total surface disturbance 20,409 acres	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; total surface disturbance 20,409 acres	Total surface disturbance 7,506 acres	Total surface disturbance 10,914 acres	Total surface disturbance 15,790 acres	Total surface disturbance 10,595 acres	Total surface disturbance 14,655 acres	Total surface disturbance reduced to 18,198 acres	Total surface disturbance 12,013 acres; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Artifact collection/site vandalism	Total surface disturbance of 4,209 acres; no new surface disturbance beyond that currently authorized; no increased human presence	Total surface disturbance of 20,409 acres; LOP extended 13 years over No Action	Same as Proposed Action (total surface disturbance of 20,409 acres) but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	Total surface disturbance of 7,506 acres; LOP extended 13-42 years over No Action	Total surface disturbance of 10,914 acres; LOP extended 5-17 years over No Action	Total surface disturbance of 15,790 acres; LOP extended 9-30 years over No Action	Total surface disturbance of 10,595 acres; LOP extended 13-42 years over No Action	Total surface disturbance of 14,655 acres; LOP extended 13-42 years over No Action	Total surface disturbance of 18,198 acres; LOP extended 13-42 years over No Action	Total surface disturbance of 12,013 acres; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; LOP extended 13 years over No Action
Disturbance of Native American religious or culturally significant sites	Avoidance of known sites and continued consultation would minimize potential impact severity; no new disturbance	Avoidance of known sites and continued consultation would minimize potential impact severity; total surface disturbance of 20,409 acres	Same as Proposed Action (total surface disturbance of 20,409 acres) but possibly increased in areas that would have been avoided by Proposed Action	Total surface disturbance of 7,506 acres	Total surface disturbance of 10,914 acres	Total surface disturbance of 15,790 acres	Total surface disturbance of 10,595 acres	Total surface disturbance of 14,655 acres	Total surface disturbance of reduced to 18,198 acres	Total surface disturbance of 12,013 acres; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
SOCIOECONOMICS										
Local population increase	Up to 13,947 new secondary labor Annual Job Equivalents (AJEs) from production for 63-year LOP; no population impact anticipated beyond existing levels; some job loss may occur as wells become less productive and abandonment begins to occur	Up to 9,899 new worker-years direct labor and 52,930 new AJEs secondary labor for development; 6,964 new worker-years and 32,923 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13 years over No Action	Up to 9,899 new worker-years direct labor and 60,625-61,110 new AJEs secondary labor for development; 6,964 new worker-years and 33,939 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13-42 years over No Action	Up to 9,899 new worker-years direct labor and 60,625-61,110 new AJEs secondary labor for development; 6,964 new worker-years and 25,374 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13-42 years over No Action	Up to 3,392 new worker years direct labor and 21,617-22,199 new AJEs secondary labor for development; 3,018 new worker years and 27,583 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 5-17 years over No Action	Up to 7,089 new worker years direct labor and 38,466-38,474 new AJEs secondary labor for development; 5,081 new worker years and 31,200 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 9-30 years over No Action	Up to 9,899 new worker years direct labor and 59,868-80,315 new AJEs secondary labor for development; 6,964 new worker years and 26,112 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13-42 years over No Action	Up to 9,899 new worker years direct labor and 57,823-99,071 new AJEs secondary labor for development; 6,964 new worker years and 29,775 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13-42 years over No Action	Up to 9,899 new worker years direct labor and 53,740-54,193 new AJEs secondary labor for development; 6,964 new worker years and 32,634 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13-42 years over No Action	Up to 9,899 new worker years direct labor and 53,740-54,193 new AJEs secondary labor for development; 6,964 new worker years and 32,634 new AJEs secondary labor for LOP from production; no impact to population anticipated due to Operator-committed recruitment from local population; some unquantifiable in-migration may occur from active job-seekers; LOP extended 13 years over No Action
Increased demand for housing	No further impact anticipated beyond existing levels	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated
Increased demand for services	No further impact anticipated beyond existing levels	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated	No significant increase in population anticipated
Change of community character	No impact anticipated beyond existing change in social values and beliefs	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative	Impacts greater than those described under the No Action Alternative
Increased tax revenues and royalties	Continued tax revenue and royalty streams for 63-year LOP; tax revenues and royalty streams would decline as wells become less productive; potential tax revenues and royalties would remain unrealized due to lack of new development and failure to recover mineral resources	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative	Tax revenues and royalties would be expected to increase in proportion to number of new wells developed and increased production from mineral resources; impacts greater than those described under the No Action Alternative
Loss of revenues from livestock grazing due to loss of animal unit months (AUMs)	$44,041 annual loss over 63-year LOP if all AUMs lost	Loss of $115 per AUM; possible loss of $202,497 annually over LOP if all AUMs lost; LOP extended 13 years over No Action	Loss of $115 per AUM; possible loss of $202,497 annually over LOP if all AUMs lost; LOP extended 13-42 years over No Action	Loss of $115 per AUM; possible loss of $75,778 annually over LOP if all AUMs lost; LOP extended 13-42 years over No Action	Loss of $115 per AUM; possible loss of $109,241 annually over LOP if all AUMs lost; LOP extended 5-17 years over No Action	Loss of $115 per AUM; possible loss of $157,076 annually over LOP if all AUMs lost; LOP extended 9-30 years over No Action	Loss of $115 per AUM; possible loss of $111,310 annually over LOP if all AUMs lost; LOP extended 13-42 years over No Action	Loss of $115 per AUM; possible loss of $145,807 annually over LOP if all AUMs lost; LOP extended 13-42 years over No Action	Loss of $115 per AUM; possible loss of $171,335 annually over LOP if all AUMs lost; LOP extended 13-42 years over No Action	Loss of $115 per AUM; possible loss of $171,335 annually over LOP if all AUMs lost; LOP extended 13-42 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Loss of hunting revenues	No impact anticipated beyond existing levels; LOP would be 63 years	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13-42 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13-42 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 5-17 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 9-30 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13-42 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13-42 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13-42 years over No Action; impacts greater than those described under the No Action Alternative	Loss of $963 per hunter day; possible loss of $42,140 annually over LOP if all hunter days lost; LOP extended 13 years over No Action; impacts greater than those described under the No Action Alternative; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
Loss of recreation revenues	No impact anticipated beyond existing levels; LOP would be 63 years	Loss of $29.62 per recreational visitor days (RVDs); possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13-42 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13-42 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 5-17 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 9-30 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13-42 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13-42 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13-42 years over No Action	Loss of $29.62 per RVD; possible loss of $100,590 annually over LOP if all RVDs are lost; LOP extended 13 years over No Action
Stimulation of local economics	No new development; up to $311 million revenues and $12 million secondary labor earnings from production annually for 63-year LOP	Up to $552 million direct economic impact and up to $135 million secondary labor earnings annually from development; up to $560 million revenues and up to $21 million in secondary labor earnings from production annually for LOP; LOP extended 13 years over No Action	Up to $547 million direct economic impact and up to $133 million secondary labor earnings annually from development; up to $577 million revenues and up to $22 million in secondary labor earnings from production annually for LOP; LOP extended 13-42 years over No Action	Up to $607 million direct economic impact and up to $155 million secondary labor earnings annually from development; up to $432 million revenues and up to $16 million in secondary labor earnings from production annually for LOP; LOP extended 13-42 years over No Action	Up to $560 million direct economic impact and up to $138 million secondary labor earnings annually from development; up to $547 million revenues and up to $21 million in secondary labor earnings from production annually for LOP; LOP extended 5-17 years over No Action	Up to $556 million direct economic impact and up to $136 million secondary labor earnings annually from development; up to $570 million revenues and up to $22 million in secondary labor earnings from production annually for LOP; LOP extended 9-30 years over No Action	Up to $602 million direct economic impact and up to $153 million secondary labor earnings annually from development; up to $444 million revenues and up to $17 million in secondary labor earnings from production annually for LOP; LOP extended 13-42 years over No Action	Up to $587 million direct economic impact and up to $148 million secondary labor earnings annually from development; up to $506 million revenues and up to $19 million in secondary labor earnings from production annually for LOP; LOP extended 13-42 years over No Action	Up to $558 million direct economic impact and up to $137 million secondary labor earnings annually from development; up to $555 million revenues from production annually for LOP; LOP extended 13-42 years over No Action	Up to $558 million direct economic impact and up to $137 million secondary labor earnings annually from development; up to $555 million revenues from production annually for LOP; LOP extended 13 years over No Action
Environmental justice for LOP	No impact anticipated; no minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area	No minority communities in study area; no low-income populations in study area
LAND USE/LIVESTOCK GRAZING										
Loss of animal unit months (AUMs) for livestock, wild horses, and wildlife for LOP	Maximum loss of 342 AUMs and 116 AUMs for the 63-year LOP; no new AUM losses	Maximum short-term loss of 1,720 AUMs and 509 AUMs lost for the LOP; approximately 1,240 AUMs would be reclaimed during LOP to provide forage within 10-12 years of disturbance; increased loss of 1,378 AUMs short-term and 393 AUMs for the LOP above No Action; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	Maximum short-term loss of 618 AUMs and 218 AUMs lost for the LOP; increased loss of 276 AUMs (maximum) and 102 AUMs for the LOP above No Action; LOP extended 13-42 years over No Action	Maximum short-term loss of 909 AUMs and 284 AUMs lost for the LOP; increased loss of 567 AUMs (maximum) and 168 AUMs for the LOP above No Action; LOP extended 5-17 years over No Action	Maximum short-term loss of 1,325 AUMs and 400 AUMs lost for the LOP; increased loss of 983 AUMs (maximum) and 284 AUMs for the LOP above No Action; LOP extended 9-30 years over No Action	Maximum short-term loss of 881 AUMs and 300 AUMs lost for the LOP; increased loss of 539 AUMs (maximum) and 184 AUMs for the LOP above No Action; LOP extended 13-42 years over No Action	Maximum short-term loss of 1,227 AUMs and 336 AUMs lost for the LOP; increased loss of 885 AUMs (maximum) and 219 AUMs for the LOP above No Action; LOP extended 13-42 years over No Action	Maximum short-term loss of 1,531 AUMs and 455 AUMs lost for the LOP; increased loss of 1,189 AUMs (maximum) and 339 AUMs for the LOP above No Action; LOP extended 13-42 years over No Action	Maximum short-term loss of 1,002 AUMs and 310 AUMs lost for the LOP; increased loss of 660 AUMs (maximum) and 194 AUMs for the LOP above No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives; LOP extended 13 years over No Action
LAND USE/RECREATION										
Reduced recreational use of JIDPA and adjacent areas for LOP	No additional impacts to recreational resources beyond existing levels; LOP would be 63 years	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 13-42 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 5-17 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 9-30 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 13-42 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 13-42 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 13-42 years over No Action	Displacement of existing dispersed recreation (e.g., hunting, wildlife viewing, photography) due to the increased level of development (e.g., facilities noise, traffic, dust, human presence) and the perceived reduction in the quality of the recreational experience; LOP extended 13 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	NO ACTION	PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)	ALTERNATIVE A (3,100 Wells And Pads)	ALTERNATIVE B (3,100 Wells And No New Pads)	ALTERNATIVE C (1,250 Wells And Pads)	ALTERNATIVE D (2,220 Wells And Pads)	ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)	ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)	ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)	PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)
LAND USE/TRANSPORTATION										
Increased road miles and road density in JIDPA for 63-year LOP	An additional 199 miles of currently authorized by BLM collector roads	An additional 465 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13-42 years over No Action	No new roads; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13-42 years over No Action	An additional 188 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 5-17 years over No Action	An additional 330 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 9-30 years over No Action	An additional 40 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13-42 years over No Action	An additional 154 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13-42 years over No Action	An additional 453 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13-42 years over No Action	An additional 664 miles of resource roads, 8 miles of collector roads, and 12 miles of Burma Road improvement above No Action; impact severity would be somewhat mitigated with adherence to the Transportation Plan; LOP extended 13 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Increased traffic for the 63-year LOP	Traffic would be maintained at existing levels with some potential for reduction	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 13-42 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 5-17 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 9-30 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 13-42 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 13-42 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 13-42 years over No Action	Traffic increase may cause congestion, road damage, and increased collision potential; new and existing roads would be built and maintained to facilitate safety and accommodate increased traffic; adherence to the Transportation Plan would to some extent mitigate impact severity; LOP extended 13 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
VISUAL RESOURCES										
Modification to basic visual elements and changes in visual character of JIDPA for the LOP and until areas reclaimed	No additional impacts to visual resources beyond current authorized actions for the 43-year LOP	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 13-42 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 5-17 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 9-30 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 13-42 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 13-42 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 13-42 years over No Action	Continued long-term modification of visual characteristics; current visual resource management (VRM) Class IV designation of JIDPA would be maintained; LOP extended 13 years over No Action; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives
Light pollution effects at JIDPA and viewsheds where JIDPA is visible	No additional impacts beyond current levels; duration of impacts would be 63 years	Light impacts would be increased due to additional development; duration of impacts would be 76 years	Light impacts would be increased due to additional development; duration of impacts would be 76-105 years	Light impacts would be increased due to additional development; duration of impacts would be 76-105 years	Light impacts would be increased due to additional development; duration of impacts would be 68-80 years	Light impacts would be increased due to additional development; duration of impacts would be 72-93 years	Light impacts would be increased due to additional development; duration of impacts would be 76-105 years	Light impacts would be increased due to additional development; duration of impacts would be 76-105 years	Light impacts would be increased due to additional development; duration of impacts would be 76-105 years	Light impacts would be increased due to additional development; duration of impacts would be 76 years; potential for impacts generally would be lower than as described for other action alternatives because of the implementation of management requirements and monitoring designed to ensure that the project meets field development and production objectives

Table E-1 (continued)

IMPACT BY ENVIRONMENTAL RESOURCE	**NO ACTION**	**PROPOSED ACTION (3,100 Wells/16,200 Acres Disturbance)**	**ALTERNATIVE A (3,100 Wells And Pads)**	**ALTERNATIVE B (3,100 Wells And No New Pads)**	**ALTERNATIVE C (1,250 Wells And Pads)**	**ALTERNATIVE D (2,220 Wells And Pads)**	**ALTERNATIVE E [2] (266 New Pads; 16 Total Pads/Section)**	**ALTERNATIVE F [2] (1,028 New Pads; 32 Total Pads/Section)**	**ALTERNATIVE G [2] (2,553 New Pads; 64 Total Pads/Section)**	**PREFERRED ALTERNATIVE [2] (Specific Maximum Disturbance Allowances, Mitigation/Monitoring)**
HAZARDOUS MATERIALS										
Soil, surface water, and ground water contamination and wildlife exposure from accidental spills, pipeline ruptures, etc., for the LOP	No additional opportunities for material spills, pipeline ruptures, and/or exposure to hazardous materials above present approved levels; LOP would be 63 years	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 13 years over No Action	Same as Proposed Action but possibly increased in areas that would have been avoided by Proposed Action; LOP extended 13-42 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 13-42 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 5-17 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 9-30 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 13-42 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 13-42 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 13-42 years over No Action	Increased above No Action due to more materials, produced, used, stored, and transported; adherence to SPCCPs, SWPPPs, and other applicable local, state, and federal rules and regulations and appropriate monitoring, containment, and disposal of hazardous materials would limit potential impact severity; LOP extended 13 years over No Action

[1] Impacts assume successful implementation of the variously proposed mitigation/monitoring/development requirements (see Appendices A and B).
[2] Assumes 3,100 additional wells.

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APPENDIX F — AIR QUALITY IMPACT TABLES

Table F-1 Summary of Maximum Modeled Near-field NO_2 Concentrations Compared to Ambient Air Quality Standards and PSD Class II Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative	Averaging Time	Direct Modeled Impact[1]	PSD Class II Increment[1]	Background Concentration[1]	Total Concentration[1]	NAAQS/ WAAQS[1]	Percent of NAAQS/ WAAQS
No Action	Annual	nm[2]	25	3.4	3.4	100	3
Proposed Action[3]	Annual	18.9	25	3.4	22.3	100	22
Alternative A[3]	Annual	18.9	25	3.4	22.3	100	22
Alternative B[3]	Annual	18.9	25	3.4	22.3	100	22
Alternative C[4]	Annual	18.6	25	3.4	22.0	100	22
Alternative D[5]	Annual	18.8	25	3.4	22.2	100	22
Alternative E[3]	Annual	18.9	25	3.4	22.3	100	22
Alternative F[3]	Annual	18.9	25	3.4	22.3	100	22
Alternative G[3]	Annual	18.9	25	3.4	22.3	100	22
Preferred Alternative[3]	Annual	18.9	25	3.4	22.3	100	22

1 In µg/m^3.
2 nm = not modeled.
3 Assumes 3,100 wells.
4 Assumes 1,250 wells.
5 Assumes 2,200 wells.

Table F-2 Summary of Maximum Modeled Near-field CO Concentrations Compared to Ambient Air Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative	Averaging Time	Direct Modeled Impact[1]	Background Concentration[1]	Total Concentration[1]	NAAQS/ WAAQS[1]	Percent of NAAQS/ WAAQS
No Action	1-hour	nm[2]	3,336	3,336.0	40,000	8
	8-hour	nm[2]	1,381	1,381.0	10,000	14
Proposed Action[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16
Alternative A[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16
Alternative B[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16
Alternative C[4]	1-hour	439.0	3,336	3,775.0	40,000	9
	8-hour	262.1	1,381	1,643.1	10,000	16
Alternative D[5]	1-hour	449.3	3,336	3,785.3	40,000	9
	8-hour	264.1	1,381	1,645.1	10,000	16
Alternative E[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16
Alternative F[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16
Alternative G[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16
Preferred Alternative[3]	1-hour	459.1	3,336	3,795.1	40,000	9
	8-hour	266.0	1,381	1,647.0	10,000	16

[1] In $\mu g/m^3$.
[2] nm = not modeled.
[3] Assumes 3,100 wells.
[4] Assumes 1,250 wells.
[5] Assumes 2,200 wells.

Table F-3 Summary of Maximum Modeled Near-field SO_2 Concentrations Compared to Ambient Air Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative	Averaging Time	Direct Modeled Impact[1]	Background Concentration[1]	Total Concentration[1]	NAAQS/ WAAQS[1]	Percent of NAAQS/ WAAQS
No Action	3-hour	nm[2]	132	132.0	1,300	10
	24-hour	nm[2]	43	43.0	365/260	12/17
	Annual	nm[2]	9	9.0	80/60	11/15
Proposed Action[3]	3-hour	103.8	132	235.8	1,300	18
	24-hour	36.7	43	79.7	365/260	22/31
	Annual	5.2	9	14.2	80/60	18/24
Alternative A[3]	3-hour	103.8	132	235.8	1,300	18
	24-hour	36.7	43	79.7	365/260	22/31
	Annual	5.2	9	14.2	80/60	18/24
Alternative B[4]	3-hour	128.3	132	260.3	1,300	20
	24-hour	45.3	43	88.3	365/260	24/34
	Annual	6.4	9	15.4	80/60	19/26
Alternative C[3]	3-hour	103.8	132	235.8	1,300	18
	24-hour	36.7	43	79.7	365/260	22/31
	Annual	5.2	9	14.2	80/60	18/24
Alternative D[3]	3-hour	103.8	132	235.8	1,300	18
	24-hour	36.7	43	79.7	365/260	22/31
	Annual	5.2	9	14.2	80/60	18/24
Alternative E[4]	3-hour	128.3	132	260.3	1,300	20
	24-hour	45.3	43	88.3	365/260	24/34
	Annual	6.4	9	15.4	80/60	19/26
Alternative F[4]	3-hour	128.3	132	260.3	1,300	20
	24-hour	45.3	43	88.3	365/260	24/34
	Annual	6.4	9	15.4	80/60	19/26
Alternative G[4]	3-hour	128.3	132	260.3	1,300	20
	24-hour	45.3	43	88.3	365/260	24/34
	Annual	6.4	9	15.4	80/60	19/26
Preferred Alternative[4]	3-hour	128.3	132	260.3	1,300	20
	24-hour	45.3	43	88.3	365/260	24/34
	Annual	6.4	9	15.4	80/60	19/26

1 In $\mu g/m^3$.
2 nm = not modeled.
3 Assumes straight drilling.
4 Assumes directional drilling.

Table F-4 Summary of Maximum Modeled Near-field PM_{10} Concentrations Compared to Ambient Air Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative	Averaging Time	Direct Modeled Impact[1]	Background Concentration[1]	Total Concentration[1]	NAAQS/ WAAQS[1]	Percent of NAAQS/ WAAQS
No Action	24-hour	nm[2]	33	33.0	150	22
	Annual	nm[2]	16	16.0	50	32
Proposed Action[3]	24-hour	74.1	33	107.1	150	71
	Annual	3.4	16	19.4	50	39
Alternative A[3]	24-hour	74.1	33	107.1	150	71
	Annual	3.4	16	19.4	50	39
Alternative B[4]	24-hour	102.1	33	135.1	150	90
	Annual	5.6	16	21.6	50	43
Alternative C[3]	24-hour	74.1	33	107.1	150	71
	Annual	3.4	16	19.4	50	39
Alternative D[3]	24-hour	74.1	33	107.1	150	71
	Annual	3.4	16	19.4	50	39
Alternative E[4]	24-hour	102.1	33	135.1	150	90
	Annual	5.6	16	21.6	50	43
Alternative F[5]	24-hour	94.0	33	127.0	150	85
	Annual	4.7	16	20.7	50	41
Alternative G[3]	24-hour	74.1	33	107.1	150	71
	Annual	3.4	16	19.4	50	39
Preferred Alternative[5]	24-hour	94.0	33	127.0	150	85
	Annual	4.7	16	20.7	50	41

1 In $\mu g/m^3$.
2 nm = not modeled.
3 Assumes 3.8-acre well pads.
4 Assumes 10.0-acre well pads.
5 Assumes 7.0-acre well pads.

Table F-5 Summary of Maximum Modeled Near-field $PM_{2.5}$ Concentrations Compared to Ambient Air Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative	Averaging Time	Direct Modeled Impact[1]	Background Concentration[1]	Total Concentration[1]	NAAQS/ WAAQS[1,2]	Percent of NAAQS/ WAAQS
No Action	24-hour	nm[3]	13	13.0	65	20
	Annual	nm[3]	5	5.0	15	33
Proposed Action[4]	24-hour	27.0	13	40.0	65	62
	Annual	1.3	5	6.3	15	42
Alternative A[4]	24-hour	27.0	13	40.0	65	62
	Annual	1.3	5	6.3	15	42
Alternative B[5]	24-hour	32.2	13	45.2	65	70
	Annual	1.8	5	6.8	15	45
Alternative C[4]	24-hour	27.0	13	40.0	65	62
	Annual	1.3	5	6.3	15	42
Alternative D[4]	24-hour	27.0	13	40.0	65	62
	Annual	1.3	5	6.3	15	42
Alternative E[5]	24-hour	32.2	13	45.2	65	70
	Annual	1.8	5	6.8	15	45
Alternative F[6]	24-hour	31.0	13	44.0	65	68
	Annual	1.6	5	6.6	15	44
Alternative G[4]	24-hour	27.0	13	40.0	65	62
	Annual	1.3	5	6.3	15	42
Preferred Alternative[6]	24-hour	31.0	13	44.0	65	68
	Annual	1.6	5	6.6	15	44

1 In $\mu g/m^3$.
2 The WAAQS are not yet enforced in Wyoming per Wyoming Air Quality Standards and Regulations (WAQSR) Chapter 2, Section 2(b)(b).
3 nm = not modeled.
4 Assumes 3.8-acre well pads.
5 Assumes 10-acre well pads.
6 Assumes 7-acre well pads.

Table F-6 Summary of Maximum Modeled Near-field O_3 Concentrations Compared to Ambient Air Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative	Averaging Time	Direct Modeled Impact[1]	Background Concentration[1]	Total Concentration[1]	NAAQS/ WAAQS[1]	Percent of NAAQS/ WAAQS
No Action	1-hour	nm[2]	75.2	75.2	235	32
	8-hour	nm[2]	75.2	75.2	157	48
All Alternatives	1-hour	111.8	75.2	187.0	235	80
	8-hour	78.3	75.2	153.5	157	98

1 In $\mu g/m^3$.
2 nm = not modeled.

Table F-7 Summary of Maximum Modeled HAP Concentrations from Direct Project Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Benzene			Toluene			Ethylbenzene			Xylene			n-Hexane			Formaldehyde		
Alternative	Averaging Period	Health-based Level[1,2]	Concen-tration[2]	Percent of Health-based Standard	Health-based Level[1,2]	Concen-tration[2]	Percent of Health-based Standard	Health-based Level[1,2]	Concen-tration[2]	Percent of Health-based Standard	Health-based Level[1,2]	Concen-tration[2]	Percent of Health-based Standard	Health-based Level[1,2]	Concen-tration[2]	Percent of Health-based Standard	Health-based Level[1,2]	Concen-tration[2]	Percent of Health-based Standard
No Action[3]	1-Hour	1,300	0.0	0.0	37,000	0.0	0.0	35,000	0.0	0.0	22,000	0.0	0.0	39,000	0.0	0.0	94	0.0	0.0
	Annual	30	0.0	0.0	400	0.0	0.0	1,000	0.0	0.0	430	0.0	0.0	200	0.0	0.0	9.8	0.0	0.0
Proposed Action[4]	1-Hour	1,300	996	76.6	37,000	1,994	5.4	35,000	109	0.3	22,000	1,085	4.9	39,000	536	1.4	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2
Alternative A[4]	1-Hour	1,300	996	76.6	37,000	1,994	5.4	35,000	109	0.3	22,000	1,085	4.9	39,000	536	1.4	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2
Alternative B[5]	1-Hour	1,300	309	23.8	37,000	619	1.7	35,000	34	0.1	22,000	337	1.5	39,000	166	0.4	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2
Alternative C[6]	1-Hour	1,300	590	45.4	37,000	1,181	3.2	35,000	64	0.2	22,000	643	2.9	39,000	317	0.8	94	31.9	33.9
	Annual	30	0.35	1.2	400	0.71	0.2	1,000	0.04	0.004	430	0.38	0.09	200	0.14	0.07	9.8	0.02	0.2
Alternative D[7]	1-Hour	1,300	566	43.5	37,000	1,132	3.1	35,000	62	0.2	22,000	616	2.8	39,000	304	0.8	94	31.9	33.9
	Annual	30	0.61	2.0	400	1.23	0.3	1,000	0.07	0.007	430	0.66	0.15	200	0.25	0.13	9.8	0.02	0.2
Alternative E[5]	1-Hour	1,300	309	23.8	37,000	619	1.7	35,000	34	0.1	22,000	337	1.5	39,000	166	0.4	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2
Alternative F[6]	1-Hour	1,300	590	45.4	37,000	1,181	3.2	35,000	64	0.2	22,000	643	2.9	39,000	317	0.8	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2
Alternative G[7]	1-Hour	1,300	566	43.5	37,000	1,132	3.1	35,000	62	0.2	22,000	616	2.8	39,000	304	0.8	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2
Preferred Alternative[5]	1-Hour	1,300	309	23.8	37,000	619	1.7	35,000	34	0.1	22,000	337	1.5	39,000	166	0.4	94	31.9	33.9
	Annual	30	0.85	2.8	400	1.73	0.4	1,000	0.09	0.01	430	0.93	0.2	200	0.35	0.2	9.8	0.02	0.2

1 Based on EPA (2002).
2 In $\mu g/m^3$.
3 No Action Alternative was not modeled.
4 Assumes 5-acre well spacing.
5 Assumes 40-acre well spacing.
6 Assumes 20-acre well spacing.
7 Assumes 10-acre well spacing.

Table F-8 Summary of Long-Term MLE and MEI Cancer Risk Analyses, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

			MLE			MEI		
Alternative	HAP Constituent	Modeled Concentration[2]	Unit Risk Factor[3]	Exposure Adjust-ment Factor	Cancer Risk	Unit Risk Factor[3]	Exposure Adjust-ment Factor	Cancer Risk
No Action[3]	Benzene	0.0	7.8E-06	0.0949	--	7.8E-06	0.71	--
	Formaldehyde	0.0	1.3E-05	0.0949	--	1.3E-05	0.71	--
	Total Combined							
Proposed Action	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				6.5E-07			
Alternative A	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				6.5E-07			
Alternative B	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				6.5E-07			
Alternative C	Benzene	0.35	7.8E-06	0.0949	2.6E-07	7.8E-06	0.71	1.94E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				2.8E-07			
Alternative D	Benzene	0.61	7.8E-06	0.0949	4.5E-07	7.8E-06	0.71	3.38E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				4.7E-07	4.9E-06		306E-06
Alternative E	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				6.5E-07	4.9E-06		
Alternative F	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				6.5E-07	4.9E-06		
Alternative G	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined				6.5E-07	2.1E-06		
Preferred Alternative	Benzene	0.85	7.8E-06	0.0949	6.3E-07	7.8E-06	0.71	4.73E-06
	Formaldehyde	0.02	1.3E-05	0.0949	2.0E-08	1.3E-05	0.71	1.80E-07
	Total Combined			6.5E-07			4.9E-06	

4.9E-06

1 Based on EPA (1993, 1997).
2 In μg/m³.
3 In 1 ÷ μg/m³.
4 No Action Alternative was not modeled.

4.9E-06

4.9E-06

Table F-9 Project and Non-Project Emissions (tons/yr) Included in Far-field Analysis, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Source Category	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Project Sources				
3,100 wells – full field production (all alternatives with 3,100 producing wells)	377.6	0.7	736.1	134.1
No Action	14.5	0.0	47.0	8.6
3,100 wells, straight drilling (approximates Alternative A)				
WDR 250 wells/yr (approximates Proposed Action)	1,627.7	28.3	949.1	205.6
WDR 150 wells/yr	1,154.8	17.2	864.0	177.3
WDR 75 wells/yr	766.2	9.0	800.0	156.0
3,100 Wells, directional drilling (approximates Alternative B)				
WDR 250 wells/yr	1,828.3	34.4	960.5	217.1
WDR 150 wells/yr	1,275.2	20.9	870.8	184.1
WDR 75 wells/yr	826.4	10.8	803.4	159.4
1,250 Wells, straight drilling (approximates Alternative C)				
WDR 250 wells/yr	1,528.3	27.8	509.9	125.3
WDR 150 wells/yr	1,055.4	16.8	424.7	96.9
WDR 75 wells/yr	666.8	8.5	360.7	75.6
3,100 wells, 50% straight drilling, 50% directional drilling (approximates Alternative F)				
WDR 250 wells/yr	1,728.0	31.3	954.8	211.4
WDR 150 wells/yr	1,214.9	19.1	867.4	180.7
WDR 75 wells/yr	800.3	9.9	802.0	158.0
Non-Project Sources				
RFD	3,166.5	56.1	84.0	81.9
RFFA	486.3	-1,407.0	-1,282.8	-586.6
State-permitted	4,098.9	-61.4	559.2	516.6

[1] Non-Project emissions sources (reasonably foreseeable development [RFD] and reasonably foreseeable future actions [RFFA]) are described in Section 4.1.2.11; WDR = well development rate.

Table F-10 Summary of Maximum Modeled NO_2 Concentration Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project Sources for Comparison to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
		Direct Modeled Impact[2]	Total Concen-tration[3]	Direct Modeled Impact[2]	Total Concen-tration[3]	Direct Modeled Impact[2]	Total Concen-ration[3]	Direct Modeled Impact[2]	Total Concen-tration[3]	Direct Modeled Impact[2]	Total Concen-tration[3]	Direct Modeled Impact[2]	Total Concen-tration[3]	Direct Modeled Impact[2]	Total Concen-tration[3]	Direct Modeled Impact[2]	Total Concen-tration[3]
Alternative or Development Phase	WDR	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual
No Action[4]	--	--	3.40	--	3.40	--	3.40	--	3.40	--	3.40	--	3.40	--	3.40	--	3.40
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.026	3.43	0.001	3.40	0.009	3.41	0.006	3.41	0.000	3.40	0.000	3.40	0.000	3.40	0.000	3.40
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.132	3.53	0.006	3.41	0.044	3.44	0.026	3.43	0.002	3.40	0.001	3.40	0.001	3.40	0.001	3.40
Alternative A	150	0.091	3.49	0.004	3.40	0.031	3.43	0.019	3.42	0.001	3.40	0.001	3.40	0.000	3.40	0.001	3.40
	75	0.057	3.46	0.003	3.40	0.021	3.42	0.012	3.41	0.001	3.40	0.000	3.40	0.000	3.40	0.000	3.40
Alternative B	250	0.153	3.55	0.006	3.41	0.050	3.45	0.030	3.43	0.002	3.40	0.001	3.40	0.001	3.40	0.001	3.40
	150	0.103	3.50	0.004	3.40	0.035	3.43	0.021	3.42	0.001	3.40	0.001	3.40	0.000	3.40	0.001	3.40
	75	0.062	3.46	0.003	3.40	0.023	3.42	0.013	3.41	0.001	3.40	0.000	3.40	0.000	3.40	0.001	3.40
Alternative C	250	0.121	3.52	0.005	3.41	0.041	3.44	0.024	3.42	0.002	3.40	0.001	3.40	0.001	3.40	0.001	3.40
	150	0.080	3.48	0.003	3.40	0.028	3.43	0.016	3.42	0.001	3.40	0.000	3.40	0.000	3.40	0.001	3.40
	75	0.045	3.45	0.002	3.40	0.017	3.42	0.010	3.41	0.001	3.40	0.000	3.40	0.000	3.40	0.000	3.40
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.141	3.54	0.006	3.41	0.046	3.45	0.027	3.43	0.002	3.40	0.001	3.40	0.001	3.40	0.001	3.40
	150	0.096	3.50	0.004	3.40	0.033	3.43	0.019	3.42	0.001	3.40	0.001	3.40	0.000	3.40	0.001	3.40
	75	0.063	3.46	0.003	3.40	0.023	3.42	0.013	3.41	0.001	3.40	0.000	3.40	0.000	3.40	0.001	3.40
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: Annual NAAQS/WAAQS = 100 $\mu g/m^3$.
2 In $\mu g/m^3$.
3 Total concentration includes direct modeled impact and background concentration; annual background NO_2 concentration = 3.4 $\mu g/m^3$.
4 No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-11 Summary of Maximum Modeled SO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas from Direct Project Sources for Comparison to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Bridger Wilderness Class I					Fitzpatrick Wilderness Class I					Popo Agie Wilderness Class II					Wind River Roadless Area Class II				
		Direct Modeled Impact[2]			Total Concentration[3]		Direct Modeled Impact[2]			Total Concentration[3]		Direct Modeled Impact[2]			Total Concentration[3]		Direct Modeled Impact[2]			Total Concentration[3]	
Alternative or Development Phase	WDR	3-hr	24-hr	Annual	3-hr	24-hr	3-hr	24-hr	Annual	3-hr	24-hr	3-hr	24-hr	Annual	3-hr	24-hr	3-hr	24-hr	Annual	3-hr	Annual
No Action[4]	--	--	--	--	132.0	43.0	--	--	--	132.0	43.0	--	--	--	132.0	43.0	--	--	--	132.0	43.0
MAXIMUM PRODUCTION EMISSIONS																					
All alternatives with 3,100 wells	0	0.005	0.001	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0	0.002	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0
MAXIMUM FIELD EMISSIONS																					
Alternative A and Proposed Action	250	0.229	0.073	0.004	132.2	43.1	0.019	0.005	0.000	132.0	43.0	0.081	0.013	0.001	132.1	43.0	0.037	0.010	0.001	132.0	43.0
Alternative A	150	0.143	0.046	0.002	132.1	43.0	0.012	0.003	0.000	132.0	43.0	0.055	0.008	0.001	132.1	43.0	0.024	0.006	0.000	132.0	43.0
	75	0.073	0.022	0.001	132.1	43.0	0.006	0.002	0.000	132.0	43.0	0.026	0.005	0.000	132.0	43.0	0.011	0.004	0.000	132.0	43.0
Alternative B	250	0.280	0.090	0.004	132.3	43.1	0.023	0.006	0.000	132.0	43.0	0.100	0.016	0.001	132.1	43.0	0.045	0.013	0.001	132.0	43.0
	150	0.174	0.056	0.003	132.2	43.1	0.015	0.004	0.000	132.0	43.0	0.067	0.010	0.001	132.1	43.0	0.029	0.008	0.001	132.0	43.0
	75	0.089	0.027	0.001	132.1	43.0	0.008	0.002	0.000	132.0	43.0	0.032	0.006	0.000	132.0	43.0	0.014	0.004	0.000	132.0	43.0
Alternative C	250	0.227	0.073	0.004	132.2	43.1	0.019	0.005	0.000	132.0	43.0	0.081	0.013	0.001	132.1	43.0	0.036	0.010	0.001	132.0	43.0
	150	0.140	0.045	0.002	132.1	43.0	0.012	0.003	0.000	132.0	43.0	0.054	0.008	0.001	132.1	43.0	0.023	0.006	0.000	132.0	43.0
	75	0.071	0.022	0.001	132.1	43.0	0.006	0.002	0.000	132.0	43.0	0.026	0.005	0.000	132.1	43.0	0.011	0.004	0.000	132.0	43.0
Alternative D	250																				
		Alternative D was not modeled. Results would be between Alternative A and Alternative C.																			
	75																				
Alternative E	250																				
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																			
	75																				
Alternative F	250	0.254	0.079	0.004	132.3	43.1	0.021	0.006	0.000	132.0	43.0	0.090	0.014	0.001	132.1	43.0	0.041	0.011	0.001	132.0	43.0
	150	0.157	0.050	0.002	132.2	43.0	0.014	0.004	0.000	132.0	43.0	0.060	0.009	0.001	132.1	43.0	0.026	0.007	0.001	132.0	43.0
150	75	0.081	0.024	0.001	132.1	43.0	0.007	0.002	0.000	132.0	43.0	0.029	0.005	0.000	132.0	43.0	0.012	0.004	0.000	132.0	43.0
Alternative G	250																				
		Alternative G was not modeled. Results would be between Alternative A and Alternative F.																			
	75																				
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																			

[1] Ambient Air Quality Standards: 3-hr NAAQS/WAAQS = 1,300 μg/m^3; 24-hr NAAQS/WAAQS = 365 μg/m^3 (NAAQS) and 260 μg/m^3 (WAAQS); Annual NAAQS/WAAQS = 100 μg/m^3 80 (NAAQS) and 60 μg/m^3 (WAAQS).

[2] In μg/m^3.

[3] To150concentration includes direct modeled impact and background concentration; annual background SO_2 concentration = 9 μg/m^3; 8-hr background SO_2 concentration = 43 μg/m^3; 3-hr background SO_2 concentration = 32 μg/m^3; total concentration remains equal to the background conentration of 9 μg/m^3 (now shown) under all alternatives.

[4] No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-11 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I					Teton Wilderness Class I					Yellowstone National Park Class I					Washakie Wilderness Area Class I				
		Direct Modeled Impact[2]			Total Concentration[3]		Direct Modeled Impact[2]			Total Concentration[3]		Direct Modeled Impact[2]			Total Concentration[3]		Direct Modeled Impact[2]			Total Concentration[3]	
		3-hr	24-hr	Annual	3-hr	24-hr	3-hr	24-hr	Annual	3-hr	24-hr	3-hr	24-hr	Annual	3-hr	24-hr	3-hr	24-hr	Annual	3-hr	Annual
No Action[4]	--	--	--	--	132.0	43.0	--	--	--	132.0	43.0	--	--	--	132.0	43.0	--	--	--	132.0	43.0
MAXIMUM PRODUCTION EMISSIONS																					
All alternatives with 3,100 wells	0	0.000	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0	0.000	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0
MAXIMUM FIELD EMISSIONS																					
Alternative A and Proposed Action	250	0.008	0.002	0.000	132.0	43.0	0.007	0.001	0.000	132.0	43.0	0.003	0.001	0.000	132.0	43.0	0.006	0.002	0.000	132.0	43.0
Alternative A	150	0.005	0.001	0.000	132.0	43.0	0.004	0.001	0.000	132.0	43.0	0.002	0.001	0.000	132.0	43.0	0.004	0.001	0.000	132.0	43.0
	75	0.003	0.001	0.000	132.0	43.0	0.002	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0	0.003	0.001	0.000	132.0	43.0
Alternative B	250	0.009	0.003	0.000	132.0	43.0	0.009	0.002	0.000	132.0	43.0	0.004	0.001	0.000	132.0	43.0	0.007	0.002	0.000	132.0	43.0
	150	0.006	0.002	0.000	132.0	43.0	0.005	0.001	0.000	132.0	43.0	0.002	0.001	0.000	132.0	43.0	0.005	0.001	0.000	132.0	43.0
	75	0.003	0.001	0.000	132.0	43.0	0.003	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0	0.003	0.001	0.000	132.0	43.0
Alternative C	250	0.008	0.002	0.000	132.0	43.0	0.007	0.001	0.000	132.0	43.0	0.003	0.001	0.000	132.0	43.0	0.006	0.002	0.000	132.0	43.0
	150	0.005	0.001	0.000	132.0	43.0	0.004	0.001	0.000	132.0	43.0	0.002	0.001	0.000	132.0	43.0	0.004	0.001	0.000	132.0	43.0
	75	0.002	0.001	0.000	132.0	43.0	0.002	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0	0.002	0.001	0.000	132.0	43.0
Alternative D	250																				
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																			
	75																				
Alternative E	250																				
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																			
	75																				
Alternative F	250	0.009	0.003	0.000	132.0	43.0	0.008	0.001	0.000	132.0	43.0	0.003	0.001	0.000	132.0	43.0	0.007	0.002	0.000	132.0	43.0
	150	0.005	0.002	0.000	132.0	43.0	0.005	0.001	0.000	132.0	43.0	0.002	0.001	0.000	132.0	43.0	0.004	0.001	0.000	132.0	43.0
	75	0.003	0.001	0.000	132.0	43.0	0.003	0.000	0.000	132.0	43.0	0.001	0.000	0.000	132.0	43.0	0.003	0.001	0.000	132.0	43.0
Alternative G	250																				
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																			
	75																				
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																			

[1] Ambient Air Quality Standards: 3-hr NAAQS/WAAQS = 1,300 $\mu g/m^3$; 24-hr NAAQS/WAAQS = 365 $\mu g/m^3$ (NAAQS) and 260 $\mu g/m^3$ (WAAQS); Annual NAAQS/WAAQS = 100 $\mu g/m^3$ 80 (NAAQS) and 60 $\mu g/m^3$ (WAAQS).
[2] In $\mu g/m^3$.
[3] Total concentration includes direct modeled impact and background concentration; annual background SO_2 concentration = 9 $\mu g/m^3$; 8-hr background SO_2 concentration = 43 $\mu g/m^3$; 3-hr background SO_2 concentration = 32 $\mu g/m^3$; total concentration remains equal to the background conentration of 9 $\mu g/m^3$ (now shown) under all alternatives.
[4] No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-12 Summary of Maximum Modeled PM_{10} Concentrations at PSD Class I and Sensitive PSD Class II Areas from Direct Project Sources for Comparison to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative or Development Phase	WDR	Bridger Wilderness Class I				Fitzpatrick Wilderness Class I				Popo Agie Wilderness Class II				Wind River Roadless Area Class II			
		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action[4]	--	--	--	33.0	16.00	--	--	33.0	16.00	--	--	33.0	16.00	--	--	33.0	16.00
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.75	0.030	33.7	16.03	0.07	0.003	33.1	16.00	0.15	0.008	33.1	16.01	0.12	0.006	33.1	16.01
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	1.66	0.063	34.7	16.06	0.18	0.006	33.2	16.01	0.26	0.018	33.3	16.02	0.19	0.013	33.2	16.01
Alternative A	150	1.28	0.050	34.3	16.05	0.14	0.005	33.1	16.00	0.21	0.014	33.2	16.01	0.16	0.010	33.2	16.01
	75	1.00	0.039	34.0	16.04	0.10	0.004	33.1	16.00	0.18	0.011	33.2	16.01	0.14	0.008	33.1	16.01
Alternative B	250	1.70	0.068	34.7	16.07	0.20	0.007	33.2	16.01	0.24	0.02	33.2	16.02	0.19	0.014	33.2	16.01
	150	1.31	0.053	34.3	16.05	0.15	0.005	33.1	16.01	0.20	0.015	33.2	16.01	0.16	0.011	33.2	16.01
	75	0.99	0.041	34.0	16.04	0.11	0.004	33.1	16.00	0.17	0.011	33.2	16.01	0.14	0.008	33.1	16.01
Alternative C	250	1.24	0.046	34.2	16.05	0.14	0.005	33.1	16.00	0.17	0.014	33.2	16.01	0.13	0.009	33.1	16.01
	150	0.87	0.033	33.9	16.03	0.10	0.003	33.1	16.00	0.13	0.010	33.1	16.01	0.09	0.007	33.1	16.01
	75	0.59	0.022	33.6	16.02	0.06	0.002	33.1	16.00	0.09	0.007	33.1	16.01	0.07	0.005	33.1	16.00
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	1.65	0.064	34.7	16.06	0.19	0.006	33.2	16.01	0.25	0.018	33.2	16.02	0.19	0.013	33.2	16.01
	150	1.31	0.051	34.3	16.05	0.14	0.005	33.1	16.01	0.21	0.014	33.2	16.01	0.16	0.010	33.2	16.01
	75	1.04	0.041	34.0	16.04	0.11	0.004	33.1	16.00	0.18	0.011	33.2	16.01	0.14	0.008	33.1	16.01
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 150 $\mu g/m^3$; Annual NAAQS/WAAQS = 50 $\mu g/m^3$.
[2] In $\mu g/m^3$.
[3] Total concentration includes direct modeled impact and background concentration; annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.
[4] No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-12 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I				Teton Wilderness Class I				Yellowstone National Park Class I				Washakie Wilderness Area Class I			
		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action[4]	--	--	--	33.0	16.00	--	--	33.0	16.00	--	--	33.0	16.00	--	--	33.0	16.00
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.03	0.001	33.0	16.00	0.02	0.001	33.0	16.00	0.01	0.000	33.0	16.00	0.03	0.001	33.0	16.00
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.09	0.003	33.1	16.00	0.04	0.002	33.0	16.00	0.04	0.001	33.0	16.00	0.08	0.002	33.1	16.00
Alternative A	150	0.07	0.002	33.1	16.00	0.03	0.001	33.0	16.00	0.03	0.001	33.0	16.00	0.06	0.002	33.1	16.00
	75	0.05	0.001	33.0	16.00	0.03	0.001	33.0	16.00	0.02	0.001	33.0	16.00	0.04	0.001	33.0	16.00
Alternative B	250	0.10	0.003	33.1	16.00	0.05	0.002	33.0	16.00	0.05	0.001	33.0	16.00	0.08	0.002	33.1	16.00
	150	0.08	0.002	33.1	16.00	0.03	0.001	33.0	16.00	0.03	0.001	33.0	16.00	0.06	0.002	33.1	16.00
	75	0.05	0.002	33.1	16.00	0.03	0.001	33.0	16.00	0.02	0.001	33.0	16.00	0.04	0.001	33.0	16.00
Alternative C	250	0.08	0.002	33.1	16.00	0.04	0.001	33.0	16.00	0.04	0.001	33.0	16.00	0.06	0.002	33.1	16.00
	150	0.05	0.002	33.1	16.00	0.02	0.001	33.0	16.00	0.03	0.001	33.0	16.00	0.04	0.001	33.0	16.00
	75	0.03	0.001	33.0	16.00	0.02	0.001	33.0	16.00	0.02	0.000	33.0	16.00	0.03	0.001	33.0	16.00
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.10	0.003	33.1	16.00	0.04	0.002	33.0	16.00	0.04	0.001	33.0	16.00	0.08	0.002	33.1	16.00
	150	0.07	0.002	33.1	16.00	0.03	0.001	33.0	16.00	0.03	0.001	33.0	16.00	0.06	0.002	33.1	16.00
	75	0.05	0.002	33.1	16.00	0.03	0.001	33.0	16.00	0.02	0.001	33.0	16.00	0.04	0.001	33.0	16.00
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 150 μg/m^3; Annual NAAQS/WAAQS = 50 μg/m^3 .
2 In μg/m^3.
3 Total concentration includes direct modeled impact and background concentration; annual background PM_{10} concentration = 16 μg/m^3; 24-hr background PM_{10} concentration = 33 μg/m^3.
4 No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-13 Summary of Maximum Modeled $PM_{2.5}$ Concentrations at PSD Class I and Sensitive PSD Class II Areas from Direct Project Sources for Comparison to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative or Development Phase	WDR	Bridger Wilderness Class I				Fitzpatrick Wilderness Class I				Popo Agie Wilderness Class II				Wind River Roadless Area Class II			
		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action[4]	--	--	--	13.0	5.00	--	--	13.0	5.00	--	--	13.0	5.00	--	--	13.0	5.00
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.75	0.030	13.7	5.03	0.07	0.003	13.1	5.00	0.15	0.008	13.1	5.01	0.12	0.006	13.1	5.01
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	1.66	0.063	14.7	5.06	0.18	0.006	13.2	5.01	0.26	0.018	13.3	5.02	0.19	0.013	13.2	5.01
Alternative A	150	1.28	0.050	14.3	5.05	0.14	0.005	13.1	5.00	0.21	0.014	13.2	5.01	0.16	0.010	13.2	5.01
	75	1.00	0.039	14.0	5.04	0.10	0.004	13.1	5.00	0.18	0.011	13.2	5.01	0.14	0.008	13.1	5.01
Alternative B	250	1.70	0.068	14.7	5.07	0.20	0.007	13.2	5.01	0.24	0.020	13.2	5.02	0.19	0.014	13.2	5.01
	150	1.31	0.053	14.3	5.05	0.15	0.005	13.1	5.01	0.20	0.015	13.2	5.01	0.16	0.011	13.2	5.01
	75	0.99	0.041	14.0	5.04	0.11	0.004	13.1	5.00	0.17	0.011	13.2	5.01	0.14	0.008	13.1	5.01
Alternative C	250	1.24	0.046	14.2	5.05	0.14	0.005	13.1	5.00	0.17	0.014	13.2	5.01	0.13	0.009	13.1	5.01
	150	0.87	0.033	13.9	5.03	0.10	0.003	13.1	5.00	0.13	0.010	13.1	5.01	0.09	0.007	13.1	5.01
	75	0.59	0.022	13.6	5.02	0.06	0.002	13.1	5.00	0.09	0.007	13.1	5.01	0.07	0.005	13.1	5.00
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	1.65	0.064	14.7	5.06	0.19	0.006	13.2	5.01	0.25	0.018	13.2	5.02	0.19	0.013	13.2	5.01
	150	1.31	0.051	14.3	5.05	0.14	0.005	13.1	5.01	0.21	0.014	13.2	5.01	0.16	0.010	13.2	5.01
	75	1.04	0.041	14.0	5.04	0.11	0.004	13.1	5.00	0.18	0.011	13.2	5.01	0.14	0.008	13.1	5.01
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 65 μg/m³; Annual NAAQS/WAAQS = 15 μg/m³; the WAAQS are not yet enforced in Wyoming per WAQSR Chapter 2, Section 2(b)(v).
[2] In μg/m³.
[3] Total concentration includes direct modeled impact and background concentration; annual background PM_{10} concentration = 5 μg/m³; 24-hr background PM_{10} concentration = 13 μg/m³.
[4] No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-13 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I				Teton Wilderness Class I				Yellowstone National Park Class I				Washakie Wilderness Area Class I			
		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]		Direct Modeled Impact[2]		Total Concentration[3]	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action[4]	--	--	--	13.0	5.00	--	--	13.0	5.00	--	--	13.0	5.00	--	--	13.0	5.00
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.03	0.001	13.0	5.00	0.02	0.001	13.0	5.00	0.01	0.000	13.0	5.00	0.03	0.001	13.0	5.00
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.09	0.003	13.1	5.00	0.04	0.002	13.0	5.00	0.04	0.001	13.0	5.00	0.08	0.002	13.1	5.00
Alternative A	150	0.07	0.002	13.1	5.00	0.03	0.001	13.0	5.00	0.03	0.001	13.0	5.00	0.06	0.002	13.1	5.00
	75	0.05	0.001	13.0	5.00	0.03	0.001	13.0	5.00	0.02	0.001	13.0	5.00	0.04	0.001	13.0	5.00
Alternative B	250	0.10	0.003	13.1	5.00	0.05	0.002	13.0	5.00	0.05	0.001	13.0	5.00	0.08	0.002	13.1	5.00
	150	0.08	0.002	13.1	5.00	0.03	0.001	13.0	5.00	0.03	0.001	13.0	5.00	0.06	0.002	13.1	5.00
	75	0.05	0.002	13.1	5.00	0.03	0.001	13.0	5.00	0.02	0.001	13.0	5.00	0.04	0.001	13.0	5.00
Alternative C	250	0.08	0.002	13.1	5.00	0.04	0.001	13.0	5.00	0.04	0.001	13.0	5.00	0.06	0.002	13.1	5.00
	150	0.05	0.002	13.1	5.00	0.02	0.001	13.0	5.00	0.03	0.001	13.0	5.00	0.04	0.001	13.0	5.00
	75	0.03	0.001	13.0	5.00	0.02	0.001	13.0	5.00	0.02	0.000	13.0	5.00	0.03	0.001	13.0	5.00
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.10	0.003	13.1	5.00	0.04	0.002	13.0	5.00	0.04	0.001	13.0	5.00	0.08	0.002	13.1	5.00
	150	0.07	0.002	13.1	5.00	0.03	0.001	13.0	5.00	0.03	0.001	13.0	5.00	0.06	0.002	13.1	5.00
	75	0.05	0.002	13.1	5.00	0.03	0.001	13.0	5.00	0.02	0.001	13.0	5.00	0.04	0.001	13.0	5.00
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 65 μg/m^3; Annual NAAQS/WAAQS = 15 μg/m^3; the WAAQS are not yet enforced in Wyoming per WAQSR Chapter 2, Section 2(b)(v).
2 In μg/m^3.
3 Total concentration includes direct modeled impact and background concentration; annual background PM_{10} concentration = 5 μg/m^3; 24-hr background PM_{10} concentration = 13 μg/m^3.
4 No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-14 Summary of Maximum Modeled Direct NO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas Compared to PSD Significance Impact Levels (SILs) and Applicable PSD Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

		Bridger Wilderness Class I			Fitzpatrick Wilderness Class I			Popo Agie Wilderness Class II			Wind River Roadless Area Class II			Grand Teton National Park Class I			Teton Wilderness Class I			Yellowstone National Park Class I			Washakie Wilderness Area Class I		
		Direct Modeled Impact			Direct Modeled Impact			Direct Modeled Impact			Direct Modeled Impact			Direct Modeled Impact			Direct Modeled Impact			Direct Modeled Impact			Direct Modeled Impact		
Alternative or Development Phase	WDR	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment	Annual	PSD SIL[2]	PSD Increment
No Action[3]	--	--	0.1	2.5	--	0.1	2.5	--	1.0	25	--	1.0	25	--	0.1	2.5	--	0.1	2.5	--	0.1	2.5	--	0.1	2.5
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.026	0.1	2.5	0.001	0.1	2.5	0.009	1.0	25	0.006	1.0	25	0.000	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	0.132	0.1	2.5	0.006	0.1	2.5	0.044	1.0	25	0.026	1.0	25	0.002	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5
Alternative A	150	0.091	0.1	2.5	0.004	0.1	2.5	0.031	1.0	25	0.019	1.0	25	0.001	0.1	2.5	0.001	0.1	2.5	0.000	0.1	2.5	0.001	0.1	2.5
	75	0.057	0.1	2.5	0.003	0.1	2.5	0.021	1.0	25	0.012	1.0	25	0.001	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5
Alternative B	250	0.153	0.1	2.5	0.006	0.1	2.5	0.050	1.0	25	0.030	1.0	25	0.002	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5
	150	0.103	0.1	2.5	0.004	0.1	2.5	0.035	1.0	25	0.021	1.0	25	0.001	0.1	2.5	0.001	0.1	2.5	0.000	0.1	2.5	0.001	0.1	2.5
	75	0.062	0.1	2.5	0.003	0.1	2.5	0.023	1.0	25	0.013	1.0	25	0.001	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5	0.001	0.1	2.5
Alternative C	250	0.121	0.1	2.5	0.005	0.1	2.5	0.041	1.0	25	0.024	1.0	25	0.002	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5
	150	0.080	0.1	2.5	0.003	0.1	2.5	0.028	1.0	25	0.016	1.0	25	0.001	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5	0.001	0.1	2.5
	75	0.045	0.1	2.5	0.002	0.1	2.5	0.017	1.0	25	0.010	1.0	25	0.001	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	0.141	0.1	2.5	0.006	0.1	2.5	0.046	1.0	25	0.027	1.0	25	0.002	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5	0.001	0.1	2.5
	150	0.096	0.1	2.5	0.004	0.1	2.5	0.033	1.0	25	0.019	1.0	25	0.001	0.1	2.5	0.001	0.1	2.5	0.000	0.1	2.5	0.001	0.1	2.5
	75	0.063	0.1	2.5	0.003	0.1	2.5	0.023	1.0	25	0.013	1.0	25	0.001	0.1	2.5	0.000	0.1	2.5	0.000	0.1	2.5	0.001	0.1	2.5
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

1 In µg/m^3.
2 Proposed Class I significance impact level (SIL) in µg/m^3, *Federal Register* Vol. 61, No. 142, Pg. 38,292, July 23, 1996.
3 No Action Alternative was not modeled; annual background NO_2 concentration = 3.4 µg/m^3.

Table F-15 Summary of Maximum Modeled Direct SO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas Compared to PSD Significance Impact Levels (SILs) and Applicable PSD Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Alternative or Development Phase	WDR	Bridger Wilderness Class I									Fitzpatrick Wilderness Class I									Popo Agie Wilderness Class II								
		Direct Modeled Impact			PSD SIL[2]			PSD Increment			Direct Modeled Impact			PSD SIL[2]			PSD Increment			Direct Modeled Impact			PSD SIL[2]			PSD Increment		
		3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action[3]	--	--	--	--	1.0	0.2	0.1	25	5	2	--	--	--	1.0	0.2	0.1	25	5	2	--	--	--	25.0	5.0	1.0	512	91	20
MAXIMUM PRODUCTION EMISSIONS																												
All alternatives with 3,100 wells	0	0.005	0.001	0.000	1.0	0.2	0.1	25	5	2	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2	0.002	0.000	0.000	25.0	5.0	1.0	512	91	20
MAXIMUM FIELD EMISSIONS																												
Alternative A and Proposed Action	250	0.229	0.073	0.004	1.0	0.2	0.1	25	5	2	0.019	0.005	0.000	1.0	0.2	0.1	25	5	2	0.081	0.013	0.001	25.0	5.0	1.0	512	91	20
Alternative A	150	0.143	0.046	0.002	1.0	0.2	0.1	25	5	2	0.012	0.003	0.000	1.0	0.2	0.1	25	5	2	0.055	0.008	0.001	25.0	5.0	1.0	512	91	20
	75	0.073	0.022	0.001	1.0	0.2	0.1	25	5	2	0.006	0.002	0.000	1.0	0.2	0.1	25	5	2	0.026	0.005	0.000	25.0	5.0	1.0	512	91	20
Alternative B	250	0.280	0.090	0.004	1.0	0.2	0.1	25	5	2	0.023	0.006	0.000	1.0	0.2	0.1	25	5	2	0.100	0.016	0.001	25.0	5.0	1.0	512	91	20
	150	0.174	0.056	0.003	1.0	0.2	0.1	25	5	2	0.015	0.004	0.000	1.0	0.2	0.1	25	5	2	0.067	0.010	0.001	25.0	5.0	1.0	512	91	20
	75	0.089	0.027	0.001	1.0	0.2	0.1	25	5	2	0.008	0.002	0.000	1.0	0.2	0.1	25	5	2	0.032	0.006	0.000	25.0	5.0	1.0	512	91	20
Alternative C	250	0.227	0.073	0.004	1.0	0.2	0.1	25	5	2	0.019	0.005	0.000	1.0	0.2	0.1	25	5	2	0.081	0.013	0.001	25.0	5.0	1.0	512	91	20
	150	0.140	0.045	0.002	1.0	0.2	0.1	25	5	2	0.012	0.003	0.000	1.0	0.2	0.1	25	5	2	0.054	0.008	0.001	25.0	5.0	1.0	512	91	20
	75	0.071	0.022	0.001	1.0	0.2	0.1	25	5	2	0.006	0.002	0.000	1.0	0.2	0.1	25	5	2	0.026	0.005	0.000	25.0	5.0	1.0	512	91	20
Alternative D	250																											
		Alternative D was not modeled. Results would be between Alternative A and Alternative C.																										
	75																											
Alternative E	250																											
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																										
	75																											
Alternative F	250	0.254	0.079	0.004	1.0	0.2	0.1	25	5	2	0.021	0.006	0.000	1.0	0.2	0.1	25	5	2	0.090	0.014	0.001	25.0	5.0	1.0	512	91	20
150	150	0.157	0.050	0.002	1.0	0.2	0.1	25	5	2	0.014	0.004	0.000	1.0	0.2	0.1	25	5	2	0.060	0.009	0.001	25.0	5.0	1.0	512	91	20
	75	0.081	0.024	0.001	1.0	0.2	0.1	25	5	2	0.007	0.002	0.000	1.0	0.2	0.1	25	5	2	0.029	0.005	0.000	25.0	5.0	1.0	512	91	20
Alternative G	250																											
		Alternative G was not modeled. Results would be between Alternative A and Alternative F.																										
	75																											
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																										

[1] In $\mu g/m^3$.
[2] Proposed Class I significance impact level (SIL) in $\mu g/m^3$, *Federal Register* Vol. 61, No. 142, Pg. 38,292, July 23, 1996.
[3] No Action Alternative was not modeled; annual background SO_2 concentration = 9 $\mu g/m^3$; 8-hr background SO_2 concentration = 43 $\mu g/m^3$; 3-hr background SO_2 concentration = 132 $\mu g/m^3$.

150

Table F-15 (continued)

Alternative or Development Phase	WDR	Wind River Roadless Area Class II									Grand Teton National Park Class I									Teton Wilderness Class I								
		Direct Modeled Impact			PSD SIL[2]			PSD Increment			Direct Modeled Impact			PSD SIL[2]			PSD Increment			Direct Modeled Impact			PSD SIL[2]			PSD Increment		
		3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action[3]	--	--	--	--	25.0	5.0	1.0	512	91	20	--	--	--	1.0	0.2	0.1	25	5	2	--	--	--	1.0	0.2	0.1	25	5	2
MAXIMUM PRODUCTION EMISSIONS																												
All alternatives with 3,100 wells	0	0.001	0.000	0.000	25.0	5.0	1.0	512	91	20	0.000	0.000	0.000	1.0	0.2	0.1	25	5	2	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2
MAXIMUM FIELD EMISSIONS																												
Alternative A and Proposed Action	250	0.037	0.010	0.001	25.0	5.0	1.0	512	91	20	0.008	0.002	0.000	1.0	0.2	0.1	25	5	2	0.007	0.001	0.000	1.0	0.2	0.1	25	5	2
Alternative A	150	0.024	0.006	0.000	25.0	5.0	1.0	512	91	20	0.005	0.001	0.000	1.0	0.2	0.1	25	5	2	0.004	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.011	0.004	0.000	25.0	5.0	1.0	512	91	20	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2	0.002	0.000	0.000	1.0	0.2	0.1	25	5	2
Alternative B	250	0.045	0.013	0.001	25.0	5.0	1.0	512	91	20	0.009	0.003	0.000	1.0	0.2	0.1	25	5	2	0.009	0.002	0.000	1.0	0.2	0.1	25	5	2
	150	0.029	0.008	0.001	25.0	5.0	1.0	512	91	20	0.006	0.002	0.000	1.0	0.2	0.1	25	5	2	0.005	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.014	0.004	0.000	25.0	5.0	1.0	512	91	20	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2	0.003	0.000	0.000	1.0	0.2	0.1	25	5	2
Alternative C	250	0.036	0.010	0.001	25.0	5.0	1.0	512	91	20	0.008	0.002	0.000	1.0	0.2	0.1	25	5	2	0.007	0.001	0.000	1.0	0.2	0.1	25	5	2
	150	0.023	0.006	0.000	25.0	5.0	1.0	512	91	20	0.005	0.001	0.000	1.0	0.2	0.1	25	5	2	0.004	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.011	0.004	0.000	25.0	5.0	1.0	512	91	20	0.002	0.001	0.000	1.0	0.2	0.1	25	5	2	0.002	0.000	0.000	1.0	0.2	0.1	25	5	2
Alternative D	250																											
		Alternative D was not modeled. Results would be between Alternative A and Alternative C.																										
	75																											
Alternative E	250																											
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																										
	75																											
Alternative F	250	0.041	0.011	0.001	25.0	5.0	1.0	512	91	20	0.009	0.003	0.000	1.0	0.2	0.1	25	5	2	0.008	0.001	0.000	1.0	0.2	0.1	25	5	2
150	150	0.026	0.007	0.001	25.0	5.0	1.0	512	91	20	0.005	0.002	0.000	1.0	0.2	0.1	25	5	2	0.005	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.012	0.004	0.000	25.0	5.0	1.0	512	91	20	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2	0.003	0.000	0.000	1.0	0.2	0.1	25	5	2
Alternative G	250																											
		Alternative G was not modeled. Results would be between Alternative A and Alternative F.																										
	75																											
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																										

1 In $\mu g/m^3$.
2 Proposed Class I significance impact level (SIL) in $\mu g/m^3$, *Federal Register* Vol. 61, No. 142, Pg. 38,292, July 23, 1996.
3 No Action Alternative was not modeled; annual background SO_2 concentration = 9 $\mu g/m^3$; 8-hr background SO_2 concentration = 43 $\mu g/m^3$; 3-hr background SO_2 concentration = 132 $\mu g/m^3$.

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Table F-15 (continued)

Alternative or Development Phase	WDR	Yellowstone National Park Class I									Washakie Wilderness Area Class I								
		Direct Modeled Impact			PSD SIL[2]			PSD Increment			Direct Modeled Impact			PSD SIL[2]			PSD Increment		
		3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action[3]	--	--	--	--	1.0	0.2	0.1	25	5	2	--	--	--	1.0	0.2	0.1	25	5	2
MAXIMUM PRODUCTION EMISSIONS																			
All alternatives with 3,100 wells	0	0.000	0.000	0.000	1.0	0.2	0.1	25	5	2	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2
MAXIMUM FIELD EMISSIONS																			
Alternative A and Proposed Action	250	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2	0.006	0.002	0.000	1.0	0.2	0.1	25	5	2
Alternative A	150	0.002	0.001	0.000	1.0	0.2	0.1	25	5	2	0.004	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2
Alternative B	250	0.004	0.001	0.000	1.0	0.2	0.1	25	5	2	0.007	0.002	0.000	1.0	0.2	0.1	25	5	2
	150	0.002	0.001	0.000	1.0	0.2	0.1	25	5	2	0.005	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2
Alternative C	250	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2	0.006	0.002	0.000	1.0	0.2	0.1	25	5	2
	150	0.002	0.001	0.000	1.0	0.2	0.1	25	5	2	0.004	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2	0.002	0.001	0.000	1.0	0.2	0.1	25	5	2
Alternative D	250																		
		Alternative D was not modeled. Results would be between Alternative A and Alternative C.																	
	75																		
Alternative E	250																		
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																	
	75																		
Alternative F	250	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2	0.007	0.002	0.000	1.0	0.2	0.1	25	5	2
150	150	0.002	0.001	0.000	1.0	0.2	0.1	25	5	2	0.004	0.001	0.000	1.0	0.2	0.1	25	5	2
	75	0.001	0.000	0.000	1.0	0.2	0.1	25	5	2	0.003	0.001	0.000	1.0	0.2	0.1	25	5	2
Alternative G	250																		
		Alternative G was not modeled. Results would be between Alternative A and Alternative F.																	
	75																		
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																	

1 In μg/m^3.
2 Proposed Class I significance impact level (SIL) in μg/m^3, *Federal Register* Vol. 61, No. 142, Pg. 38,292, July 23, 1996.
3 No Action Alternative was not modeled; annual background SO_2 concentration = 9 μg/m^3; 8-hr background SO_2 concentration = 43 μg/m^3; 3-hr background SO_2 concentration = 132 μg/m^3.

150

Table F-16 Summary of Maximum Modeled Direct PM_{10} Concentrations at PSD Class I and Sensitive PSD Class II Areas Compared to PSD Significance Impact Levels (SILs) and Applicable PSD Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

		Bridger Wilderness Class I						Fitzpatrick Wilderness Class I						Popo Agie Wilderness Class II						Wind River Roadless Area Class II					
		Direct Modeled Impact		PSD SIL[2]		PSD Increment		Direct Modeled Impact		PSD SIL[2]		PSD Increment		Direct Modeled Impact		PSD SIL[2]		PSD Increment		Direct Modeled Impact		PSD SIL[2]		PSD Increment	
Alternative or Development Phase	WDR	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action[3]	--	--	--	0.3	0.2	8	4	--	--	0.3	0.2	8	4	--	--	5.0	1.0	30	17	--	--	5.0	1.0	30	17
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.75	0.030	0.3	0.2	8	4	0.07	0.003	0.3	0.2	8	4	0.15	0.008	5.0	1.0	30	17	0.12	0.006	5.0	1.0	30	17
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	1.66	0.063	0.3	0.2	8	4	0.18	0.006	0.3	0.2	8	4	0.26	0.018	5.0	1.0	30	17	0.19	0.013	5.0	1.0	30	17
Alternative A	150	1.28	0.050	0.3	0.2	8	4	0.14	0.005	0.3	0.2	8	4	0.21	0.014	5.0	1.0	30	17	0.16	0.010	5.0	1.0	30	17
	75	1.00	0.039	0.3	0.2	8	4	0.10	0.004	0.3	0.2	8	4	0.18	0.011	5.0	1.0	30	17	0.14	0.008	5.0	1.0	30	17
Alternative B	250	1.70	0.068	0.3	0.2	8	4	0.20	0.007	0.3	0.2	8	4	0.24	0.02	5.0	1.0	30	17	0.19	0.014	5.0	1.0	30	17
	150	1.31	0.053	0.3	0.2	8	4	0.15	0.005	0.3	0.2	8	4	0.20	0.015	5.0	1.0	30	17	0.16	0.011	5.0	1.0	30	17
	75	0.99	0.041	0.3	0.2	8	4	0.11	0.004	0.3	0.2	8	4	0.17	0.011	5.0	1.0	30	17	0.14	0.008	5.0	1.0	30	17
Alternative C	250	1.24	0.046	0.3	0.2	8	4	0.14	0.005	0.3	0.2	8	4	0.17	0.014	5.0	1.0	30	17	0.13	0.009	5.0	1.0	30	17
	150	0.87	0.033	0.3	0.2	8	4	0.10	0.003	0.3	0.2	8	4	0.13	0.010	5.0	1.0	30	17	0.09	0.007	5.0	1.0	30	17
	75	0.59	0.022	0.3	0.2	8	4	0.06	0.002	0.3	0.2	8	4	0.09	0.007	5.0	1.0	30	17	0.07	0.005	5.0	1.0	30	17
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	1.65	0.064	0.3	0.2	8	4	0.19	0.006	0.3	0.2	8	4	0.25	0.018	5.0	1.0	30	17	0.19	0.013	5.0	1.0	30	17
	150	1.31	0.051	0.3	0.2	8	4	0.14	0.005	0.3	0.2	8	4	0.21	0.014	5.0	1.0	30	17	0.16	0.010	5.0	1.0	30	17
	75	1.04	0.041	0.3	0.2	8	4	0.11	0.004	0.3	0.2	8	4	0.18	0.011	5.0	1.0	30	17	0.14	0.008	5.0	1.0	30	17
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

1 In $\mu g/m^3$.
2 Proposed Class I significance impact level (SIL) in $\mu g/m^3$, *Federal Register* Vol. 61, No. 142, Pg. 38,292, July 23, 1996.
3 No Action Alternative was not modeled; annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.

Table F-16 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I						Teton Wilderness Class I						Yellowstone National Park Class I						Washakie Wilderness Area Class I					
		Direct Modeled Impact		PSD SIL[2]		PSD Increment		Direct Modeled Impact		PSD SIL[2]		PSD Increment		Direct Modeled Impact		PSD SIL[2]		PSD Increment		Direct Modeled Impact		PSD SIL[2]		PSD Increment	
		3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action[3]	--	--	--	0.3	0.2	8	4	--	--	0.3	0.2	8	4	--	--	0.3	0.2	8	4	--	--	0.3	0.2	8	4
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.03	0.001	0.3	0.2	8	4	0.02	0.001	0.3	0.2	8	4	0.01	0.000	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	0.09	0.003	0.3	0.2	8	4	0.04	0.002	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4	0.08	0.002	0.3	0.2	8	4
Alternative A	150	0.07	0.002	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.06	0.002	0.3	0.2	8	4
	75	0.05	0.001	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.02	0.001	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4
Alternative B	250	0.10	0.003	0.3	0.2	8	4	0.05	0.002	0.3	0.2	8	4	0.05	0.001	0.3	0.2	8	4	0.08	0.002	0.3	0.2	8	4
	150	0.08	0.002	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.06	0.002	0.3	0.2	8	4
	75	0.05	0.002	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.02	0.001	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4
Alternative C	250	0.08	0.002	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4	0.06	0.002	0.3	0.2	8	4
	150	0.05	0.002	0.3	0.2	8	4	0.02	0.001	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4
	75	0.03	0.001	0.3	0.2	8	4	0.02	0.001	0.3	0.2	8	4	0.02	0.000	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	0.10	0.003	0.3	0.2	8	4	0.04	0.002	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4	0.08	0.002	0.3	0.2	8	4
	150	0.07	0.002	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.06	0.002	0.3	0.2	8	4
	75	0.05	0.002	0.3	0.2	8	4	0.03	0.001	0.3	0.2	8	4	0.02	0.001	0.3	0.2	8	4	0.04	0.001	0.3	0.2	8	4
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

1 In $\mu g/m^3$.
2 Proposed Class I significance impact level (SIL) in $\mu g/m^3$, *Federal Register* Vol. 61, No. 142, Pg. 38,292, July 23, 1996.
3 No Action Alternative was not modeled; annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.

Table F-17 Summary of Maximum Modeled Visibility Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project Sources Using FLAG Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative or Development Phase	WDR	Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
		Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv
No Action[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	1.02	1	0.13	0	0.21	0	0.18	0	0.08	0	0.03	0	0.04	0	0.06	0
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	3.16	9	0.56	0	0.54	0	0.45	0	0.32	0	0.14	0	0.16	0	0.24	0
Alternative A	150	2.36	5	0.39	0	0.39	0	0.32	0	0.23	0	0.10	0	0.11	0	0.17	0
	75	1.69	2	0.26	0	0.30	0	0.23	0	0.15	0	0.06	0	0.07	0	0.11	0
Alternative B	250	3.32	11	0.65	0	0.62	0	0.52	0	0.36	0	0.16	0	0.18	0	0.27	0
	150	2.47	6	0.44	0	0.43	0	0.36	0	0.26	0	0.11	0	0.12	0	0.19	0
	75	1.71	2	0.28	0	0.29	0	0.24	0	0.17	0	0.07	0	0.08	0	0.12	0
Alternative C	250	2.75	8	0.49	0	0.47	0	0.39	0	0.29	0	0.13	0	0.14	0	0.22	0
	150	1.92	4	0.34	0	0.32	0	0.25	0	0.20	0	0.09	0	0.10	0	0.15	0
	75	1.22	2	0.21	0	0.20	0	0.15	0	0.12	0	0.05	0	0.06	0	0.09	0
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	3.25	10	0.60	0	0.58	0	0.48	0	0.34	0	0.15	0	0.17	0	0.25	0
	150	2.44	5	0.42	0	0.41	0	0.35	0	0.24	0	0.10	0	0.12	0	0.18	0
	75	1.80	2	0.29	0	0.31	0	0.25	0	0.17	0	0.07	0	0.08	0	0.12	0
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In deciviews (dv).
[2] No Action Alternative was not modeled.

Table F-18 Summary of Maximum Modeled Visibility Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project Sources Using IMPROVE Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv
No Action[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	1.14	1	0.15	0	0.24	0	0.20	0	0.08	0	0.03	0	0.04	0	0.06	0
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	3.48	10	0.64	0	0.62	0	0.52	0	0.33	0	0.14	0	0.16	0	0.24	0
Alternative A	150	2.61	7	0.45	0	0.44	0	0.37	0	0.23	0	0.10	0	0.11	0	0.17	0
	75	1.87	3	0.30	0	0.34	0	0.26	0	0.16	0	0.07	0	0.08	0	0.11	0
Alternative B	250	3.74	11	0.75	0	0.71	0	0.60	0	0.37	0	0.16	0	0.18	0	0.27	0
	150	2.75	8	0.51	0	0.50	0	0.42	0	0.26	0	0.11	0	0.13	0	0.19	0
	75	1.90	4	0.32	0	0.34	0	0.28	0	0.17	0	0.07	0	0.08	0	0.12	0
Alternative C	250	3.04	8	0.57	0	0.54	0	0.45	0	0.29	0	0.13	0	0.15	0	0.22	0
	150	2.13	4	0.39	0	0.37	0	0.29	0	0.20	0	0.09	0	0.10	0	0.15	0
	75	1.36	2	0.24	0	0.23	0	0.18	0	0.12	0	0.05	0	0.06	0	0.09	0
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	3.57	10	0.69	0	0.66	0	0.56	0	0.34	0	0.15	0	0.17	0	0.25	0
	150	2.70	8	0.49	0	0.47	0	0.40	0	0.25	0	0.11	0	0.12	0	0.18	0
	75	2.00	4	0.34	0	0.34	0	0.28	0	0.17	0	0.07	0	0.08	0	0.12	0
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In deciviews (dv).
[2] No Action Alternative was not modeled.

Table F-19 Summary of Maximum Modeled Change in ANC at Acid-Sensitive Lakes from Direct Project Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Black Joe Lake - Bridger Wilderness Class I		Deep Lake - Bridger Wilderness Class I		Hobbs Lake - Bridger Wilderness Class I		Lazy Boy Lake - Bridger Wilderness Class I		Upper Frozen Lake - Bridger Wilderness Class I		Lower Saddlebag - Popo Agie Wilderness Class II		Ross Lake - Fitzpatrick Wilderness Class I	
Alternative or Development Phase	WDR	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change
Level of Acceptable Change	--	6.70	--	5.99	--	6.99	--	1.00	--	1.00	--	5.55	--	5.35	--
No Action[2]	--	67.0	--	59.9	--	69.9	--	18.8	--	5.0	--	55.5	--	53.5	--
MAXIMUM PRODUCTION EMISSIONS															
All alternatives with 3,100 wells	0	0.02	0.033	0.02	0.041	0.00	0.006	0.00	0.008	0.03	0.567	0.03	0.046	0.00	0.003
MAXIMUM FIELD EMISSIONS															
Alternative A and Proposed Action	250	0.10	0.155	0.11	0.190	0.02	0.030	0.01	0.038	0.14	2.808	0.13	0.231	0.01	0.013
Alternative A	150	0.07	0.109	0.08	0.133	0.01	0.021	0.01	0.027	0.10	1.969	0.09	0.161	0.01	0.009
	75	0.05	0.072	0.05	0.087	0.01	0.013	0.00	0.017	0.06	1.269	0.06	0.107	0.00	0.006
Alternative B	250	0.12	0.177	0.13	0.217	0.02	0.035	0.01	0.043	0.16	3.221	0.15	0.263	0.01	0.015
	150	0.08	0.122	0.09	0.150	0.02	0.023	0.01	0.030	0.11	2.219	0.10	0.181	0.01	0.010
	75	0.05	0.079	0.06	0.095	0.01	0.014	0.00	0.019	0.07	1.386	0.06	0.117	0.00	0.007
Alternative C	250	0.10	0.142	0.10	0.173	0.02	0.029	0.01	0.037	0.13	2.581	0.12	0.216	0.01	0.013
	150	0.06	0.096	0.07	0.117	0.01	0.019	0.00	0.025	0.09	1.741	0.08	0.146	0.00	0.009
	75	0.04	0.059	0.04	0.071	0.01	0.012	0.00	0.016	0.05	1.041	0.05	0.091	0.00	0.005
Alternative D	250														
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.													
	75														
Alternative E	250														
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.													
	75														
Alternative F	250	0.109	0.163	0.120	0.200	0.023	0.033	0.008	0.041	0.148	2.959	0.135	0.243	0.008	0.014
	150	0.076	0.113	0.082	0.138	0.015	0.022	0.005	0.028	0.102	2.047	0.093	0.168	0.005	0.010
	75	0.053	0.079	0.057	0.095	0.010	0.015	0.004	0.019	0.070	1.407	0.065	0.117	0.004	0.007
Alternative G	250														
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.													
	75														
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.													

[4] In μeq/L.
[2] No Action Alternative was not modeled; ANC represents background only.

Table F-20 Summary of Maximum Modeled Sulfur (S) Deposition Impacts at PSD Class I and Sensitive Class II Areas from Direct Project Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative or Development Phase	WDR	Bridger Wilderness Class I[1]	Fitzpatrick Wilderness Class I[1]	Popo Agie Wilderness Class II[1]	Wind River Roadless Area Class II[1]	Grand Teton National Park Class I[1]	Teton Wilderness Class I[1]	Yellowstone National Park Class I[1]	Washakie Wilderness Area Class I[1]
No Action[2]	--	--	--	--	--	--	--	--	--
MAXIMUM PRODUCTION EMISSIONS									
All alternatives with 3,100 wells	0	0.0000316	0.0000036	0.0000184	0.0000114	0.0000015	0.0000008	0.0000006	0.0000010
MAXIMUM FIELD EMISSIONS									
Alternative A and Proposed Action	250	0.0014419	0.0001484	0.0007323	0.0004267	0.0000656	0.0000367	0.0000241	0.0000425
Alternative A	150	0.0009009	0.0000920	0.0004551	0.0002642	0.0000398	0.0000223	0.0000147	0.0000258
		0.0005122	0.0000452	0.0002438	0.0001285	0.0000203	0.0000112	0.0000074	0.0000128
Alternative B	250	0.0017643	0.0001814	0.0008954	0.0005214	0.0000802	0.0000449	0.0000295	0.0000520
		0.0011000	0.0001122	0.0005549	0.0003218	0.0000486	0.0000272	0.0000180	0.0000315
		0.0006225	0.0000547	0.0002954	0.0001552	0.0000246	0.0000135	0.0000090	0.0000155
Alternative C	250	0.0014232	0.0001462	0.0007216	0.0004199	0.0000647	0.0000362	0.0000238	0.0000419
		0.0008828	0.0000899	0.0004444	0.0002574	0.0000389	0.0000218	0.0000144	0.0000252
75		0.0004942	0.0000431	0.0002331	0.0001217	0.0000194	0.0000107	0.0000071	0.0000122
Alternative D 150	250								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.							
75									
Alternative E 150	250								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.							
75									
Alternative F	250	0.0015994	0.0001645	0.0008114	0.0004722	0.0000728	0.0000407	0.0000267	0.0000471
		0.0010003	0.0001020	0.0005045	0.0002925	0.0000442	0.0000247	0.0000163	0.0000286
75		0.0005668	0.0000500	0.0002693	0.0001416	0.0000225	0.0000124	0.0000082	0.0000142
Alternative G	250								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.							
75									
Preferred Alternative 150	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.							
75									

[1] In kg/ha-yr.
[2] No Action Alternative was not modeled; sulfur deposition analysis threshold (DAT) for direct Project impacts = 0.005 kg/ha-yr.
75

Table F-21 Summary of Maximum Modeled Nitrogen (N) Deposition Impacts at PSD Class I and Sensitive Class II Areas from Direct Project Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Alternative or Development Phase	WDR	Bridger Wilderness Class I[1]	Fitzpatrick Wilderness Class I[1]	Popo Agie Wilderness Class II[1]	Wind River Roadless Area Class II[1]	Grand Teton National Park Class I[1]	Teton Wilderness Class I[1]	Yellowstone National Park Class I[1]	Washakie Wilderness Area Class I[1]
No Action[2]	--	--	--	--	--	--	--	--	--
MAXIMUM PRODUCTION EMISSIONS									
All alternatives with 3,100 wells	0	0.00669	0.00057	0.00344	0.00212	0.00023	0.00011	0.00008	0.00014
MAXIMUM FIELD EMISSIONS									
Alternative A and Proposed Action	250	0.03487	0.00266	0.01654	0.00988	0.00116	0.00056	0.00041	0.00072
Alternative A	150	0.02440	0.00187	0.01164	0.00696	0.00081	0.00039	0.00028	0.00050
		0.01653	0.00120	0.00771	0.00448	0.00052	0.00025	0.00018	0.00032
Alternative B	250	0.04017	0.00300	0.01886	0.01128	0.00131	0.00063	0.00046	0.00080
		0.02771	0.00208	0.01306	0.00781	0.00090	0.00043	0.00032	0.00055
		0.01837	0.00130	0.00844	0.00486	0.00056	0.00027	0.00020	0.00035
Alternative C	250	0.03233	0.00248	0.01527	0.00906	0.00110	0.00053	0.00038	0.00068
		0.02186	0.00170	0.01039	0.00614	0.00074	0.00036	0.00026	0.00047
		0.01399	0.00103	0.00650	0.00366	0.00046	0.00022	0.00016	0.00029
Alternative D	250								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.							
	75								
Alternative E	250								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.							
75	75								
Alternative F	250	0.03644	0.00282	0.01734	0.01037	0.00123	0.00059	0.00043	0.00076
150		0.02595	0.00198	0.01227	0.00731	0.00085	0.00041	0.00030	0.00053
75		0.01839	0.00132	0.00851	0.00495	0.00057	0.00027	0.00020	0.00035
Alternative G	250								
150	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.							
75	75								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.							

1 In kg/ha-yr.
2 No Action Alternative was not modeled; nitrogen deposition analysis threshold (DAT) for direct Project impacts = 0.005 kg/ha-yr.

150

75

Table F-22 Summary of Maximum Modeled Visibility Impacts at Wyoming Regional Communities from Direct Project Sources Using FLAG Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Big Piney		Big Sandy		Boulder		Bronx		Cora		Daniel		Farson		LaBarge		Merna		Pinedale	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv
No Action[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MAXIMUM PRODUCTION EMISSIONS																					
All alternatives with 3,100 wells	0	0.57	0	0.76	0	0.49	0	0.31	0	0.60	0	0.49	0	0.47	0	0.26	0	0.19	0	0.93	0
MAXIMUM FIELD EMISSIONS																					
Alternative A and Proposed Action	250	1.75	2	2.77	19	2.09	9	1.48	1	2.81	1	2.24	1	2.04	5	1.15	2	0.68	0	3.78	2
Alternative A	150	1.28	1	2.04	12	1.51	3	1.07	1	2.06	1	1.63	1	1.44	3	0.81	0	0.50	0	2.84	1
	75	0.89	0	1.47	2	1.00	1	0.71	0	1.37	1	1.08	1	0.98	0	0.52	0	0.33	0	1.92	1
Alternative B	250	1.87	5	3.13	24	2.35	11	1.66	1	3.19	1	2.55	1	2.29	6	1.29	2	0.78	0	4.32	3
	150	1.35	2	2.29	15	1.67	5	1.17	1	2.29	1	1.81	1	1.59	4	0.90	0	0.56	0	3.18	2
	75	0.90	0	1.61	3	1.08	2	0.73	0	1.44	1	1.15	1	1.05	1	0.57	0	0.36	0	2.09	1
Alternative C	250	1.48	2	2.50	14	1.92	6	1.32	1	2.54	1	2.00	1	1.88	5	1.10	2	0.61	0	3.39	2
	150	1.00	1	1.76	6	1.33	3	0.90	0	1.77	1	1.38	1	1.27	3	0.75	0	0.42	0	2.41	1
	75	0.60	0	1.17	1	0.81	0	0.54	0	1.05	1	0.82	0	0.80	0	0.47	0	0.26	0	1.45	1
Alternative D	250																				
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																			
	75																				
Alternative E	250																				
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																			
	75																				
Alternative F	250	1.84	4	2.90	19	2.20	10	1.55	1	2.96	1	2.36	1	2.12	5	1.21	2	0.72	0	3.98	3
	150	1.36	2	2.16	12	1.59	5	1.13	1	2.19	1	1.73	1	1.51	3	0.85	0	0.53	0	3.03	1
	75	0.96	0	1.61	4	1.10	2	0.78	0	1.51	1	1.20	1	1.07	1	0.58	0	0.37	0	2.15	1
Alternative G	250																				
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																			
	75																				
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																			

1 In deciviews (dv).
2 No Action Alternative was not modeled.

Table F-23 Summary of Maximum Modeled Visibility Impacts at Wyoming Regional Communities from Direct Project Sources Using IMPROVE Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Big Piney		Big Sandy		Boulder		Bronx		Cora		Daniel		Farson		LaBarge		Merna		Pinedale	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv
No Action[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MAXIMUM PRODUCTION EMISSIONS																					
All alternatives with 3,100 wells	0	0.66	0	0.85	0	0.56	0	0.36	0	0.69	0	0.57	0	0.55	0	0.30	0	0.22	0	1.07	1
MAXIMUM FIELD EMISSIONS																					
Alternative A and Proposed Action	250	2.01	6	3.05	23	2.39	12	1.70	1	3.20	1	2.56	1	2.33	6	1.32	2	0.79	0	4.27	3
Alternative A	150	1.48	2	2.26	13	1.73	6	1.23	1	2.36	1	1.87	1	1.65	5	0.93	0	0.57	0	3.23	2
	75	1.03	1	1.63	3	1.15	3	0.82	0	1.57	1	1.25	1	1.13	3	0.60	0	0.38	0	2.20	1
Alternative B	250	2.15	9	3.45	26	2.68	18	1.91	1	3.62	2	2.90	2	2.62	7	1.48	2	0.90	0	4.87	5
	150	1.56	2	2.53	15	1.92	6	1.35	1	2.61	1	2.07	1	1.82	5	1.03	1	0.64	0	3.61	2
	75	1.04	1	1.79	6	1.24	3	0.85	0	1.66	1	1.32	1	1.21	3	0.66	0	0.42	0	2.39	1
Alternative C	250	1.71	4	2.77	17	2.20	9	1.52	1	2.89	1	2.29	1	2.15	5	1.26	2	0.70	0	3.85	2
	150	1.16	1	1.95	8	1.53	3	1.04	1	2.03	1	1.59	1	1.46	3	0.87	0	0.49	0	2.75	1
	75	0.70	0	1.30	1	0.93	0	0.62	0	1.21	1	0.94	0	0.92	0	0.54	0	0.30	0	1.66	1
Alternative D	250																				
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																			
	75																				
Alternative E	250																				
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																			
	75																				
Alternative F	250	2.12	7	3.19	24	2.52	16	1.78	1	3.36	2	2.69	1	2.42	6	1.40	2	0.83	0	4.49	3
	150	1.57	2	2.39	14	1.82	6	1.30	1	2.50	1	1.99	1	1.74	5	0.98	0	0.61	0	3.44	2
	75	1.11	1	1.79	7	1.26	3	0.90	0	1.74	1	1.37	1	1.23	3	0.67	0	0.42	0	2.45	1
Alternative G	250																				
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																			
	75																				
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																			

1 In deciviews (dv).
2 No Action Alternative was not modeled.

Table F-24 Summary of Maximum Modeled In-field Pollutant Concentrations from Direct Project Sources Compared to Ambient Air Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Alternative or Development Phase	WDR	NO_2			SO_2									PM_{10}						$PM_{2.5}$					
		Direct Modeled Impact	Total Concentration[2]	NAAQS/WAAQS	Direct Modeled Impact			Total Concentration[2]			NAAQS/WAAQS			Direct Modeled Impact		Total Concentration[2]		NAAQS/WAAQS		Direct Modeled Impact		Total Concentration[2]		NAAQS/WAAQS[3]	
		Annual	Annual	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action[4]	--	--	3.4	100	--	--	--	132	43	9	1,300	365/260	80/60	--	--	33	16	150	50	--	--	13	5	65	15
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	2.5	5.9	100	0.2	0.1	0.0	132.2	43.1	9.0	1,300	365/260	80/60	90.4	12.6	123.4	28.6	150	50	16.3	2.0	29.3	7.0	65	15
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	13.7	17.1	100	18.3	3.7	0.4	150.3	46.7	9.4	1,300	365/260	80/60	113.2	16.0	146.2	32.0	150	50	21.6	3.1	34.6	8.1	65	15
Alternative A	150	12.0	15.4	100	13.9	3.4	0.3	145.9	46.4	9.3	1,300	365/260	80/60	103.9	14.7	136.9	30.7	150	50	19.3	2.8	32.3	7.8	65	15
	75	10.3	13.7	100	13.9	3.4	0.3	145.9	46.4	9.3	1,300	365/260	80/60	97.0	13.7	130.0	29.7	150	50	17.7	2.6	30.7	7.6	65	15
Alternative B	250	16.2	19.6	100	22.5	4.6	0.5	154.5	47.6	9.5	1,300	365/260	80/60	113.6	16.1	146.6	32.1	150	50	22.0	3.2	35.0	8.2	65	15
	150	14.3	17.7	100	17.1	4.2	0.4	149.1	47.2	9.4	1,300	365/260	80/60	104.1	14.8	137.1	30.8	150	50	19.4	2.9	32.4	7.9	65	15
	75	11.8	15.2	100	17.1	4.2	0.3	149.1	47.2	9.3	1,300	365/260	80/60	97.1	13.8	130.1	29.8	150	50	17.7	2.7	30.7	7.7	65	15
Alternative C	250	12.6	16.0	100	18.3	3.7	0.4	150.3	46.7	9.4	1,300	365/260	80/60	59.3	8.6	92.3	24.6	150	50	11.9	1.9	24.9	6.9	65	15
	150	11.0	14.4	100	13.9	3.4	0.3	145.9	46.4	9.3	1,300	365/260	80/60	49.9	7.3	82.9	23.3	150	50	9.5	1.7	22.5	6.7	65	15
	75	9.1	12.5	100	13.9	3.4	0.3	145.9	46.4	9.3	1,300	365/260	80/60	43.1	6.3	76.1	22.3	150	50	8.3	1.4	21.3	6.4	65	15
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	16.5	19.9	100	20.3	4.1	0.4	152.3	47.1	9.4	1,300	365/260	80/60	105.6	15.1	138.6	31.1	150	50	20.4	3.2	33.4	8.2	65	15
	150	15.7	19.1	100	15.4	3.8	0.4	147.4	46.8	9.4	1,300	365/260	80/60	104.0	14.9	137.0	30.9	150	50	19.4	3.1	32.4	8.1	65	15
	75	14.2	17.6	100	15.4	3.8	0.3	147.4	46.8	9.3	1,300	365/260	80/60	97.1	14.0	130.1	30.0	150	50	17.7	2.9	30.7	7.9	65	15
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

[1] In μg/m^3.
[2] Total concentration includes direct modeled impact and background concentration; annual background NO_2 concentration = 3.4 μg/m^3; annual background SO_2 concentration = 9 μg/m^3; 8-hr background SO_2 concentration = 43 μg/m^3; 3-hr background SO_2 concentration = 132 μg/m^3; annual background PM_{10} concentration = 16 μg/m^3; 24-hr background PM_{10} concentration = 33 μg/m^3; annual background $PM_{2.5}$ concentration = 5 μg/m^3; 24-hr background $PM_{2.5}$ concentration = 13 μg/m^3.
[3] WAAQS for $PM_{2.5}$ are not yet enforced in Wyoming per WAQSR Chapter 2, Section 2(b)(v).
[4] No Action Alternative was not modeled; total concentration represents background concentration only.

Table F-25 RFD Projects Included in Cumulative Analysis, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

Big Piney-LaBarge	LaBarge Creek - MA 12
BTA Bravo	Little Greys River - MA 31
Burley	Lower Bush Creek CBM (Kennedy Oil)
Burlington Little Monument	Lower Greys River - MA 32
Cave Gulch	Moxa Arch
Cliff Creek - USFS Management Area (MA) 22	Mulligan Draw
Compressor Station, Pipeline- Williams	Pinedale Anticline Project
Continental Divide/Wamsutter II EIS	Piney Creeks - MA 26
Cooper Reservoir (1998)	Pioneer Gas Plant
Copper Ridge Shallow Gas Project	Powder River Basin
Cottonwood Creek - MA 25	Riley Ridge
Creston-Blue Gap	Road Hollow
Cutthroat Gas Processing Plant	Sierra Madre
Desolation Flats	Soda Unit
Eighth Granger Gas Plant Expansion	South Baggs
Fontenelle Natural Gas Infill Drilling	South Piney
Ham's Fork Pipeline	Stage Coach
Hickey Mountain-Table Mountain	Upper Hoback - MA 23
Horse Creek - MA 24	Vermillion Basin
Horse Trap	Willow Creek - MA 49
Jack Morrow Hills	Wind River (Bureau of Indian Affairs [BIA] lead agency)

Table F-26 Summary of Maximum Modeled Cumulative NO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources for Comparison to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[2]

Alternative or Development Phase	WDR	Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
		Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]	Direct Modeled Impact	Total Concen-tration[3]
		Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual
No Action	--	0.119	3.52	0.011	3.41	0.027	3.43	0.024	3.42	0.029	3.43	0.007	3.41	0.003	3.40	0.009	3.41
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.143	3.54	0.012	3.41	0.036	3.44	0.030	3.43	0.029	3.43	0.007	3.41	0.003	3.40	0.010	3.41
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.245	3.64	0.017	3.42	0.070	3.47	0.051	3.45	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
Alternative A	150	0.203	3.60	0.015	3.42	0.057	3.46	0.043	3.44	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	75	0.170	3.57	0.014	3.41	0.047	3.45	0.036	3.44	0.029	3.43	0.007	3.41	0.003	3.40	0.010	3.41
Alternative B	250	0.265	3.67	0.017	3.42	0.076	3.48	0.055	3.45	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	150	0.216	3.62	0.016	3.42	0.060	3.46	0.045	3.45	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	75	0.175	3.57	0.014	3.41	0.049	3.45	0.037	3.44	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
Alternative C	250	0.233	3.63	0.016	3.42	0.067	3.47	0.048	3.45	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	150	0.192	3.59	0.015	3.41	0.054	3.45	0.041	3.44	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	75	0.159	3.56	0.013	3.41	0.044	3.44	0.034	3.43	0.029	3.43	0.007	3.41	0.003	3.40	0.010	3.41
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.254	3.65	0.017	3.42	0.072	3.47	0.052	3.45	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	150	0.209	3.61	0.015	3.42	0.058	3.46	0.044	3.44	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
	75	0.176	3.58	0.014	3.41	0.049	3.45	0.038	3.44	0.030	3.43	0.007	3.41	0.003	3.40	0.010	3.41
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: annual NAAQS/WAAQS = 100 $\mu g/m^3$.
2 In $\mu g/m^3$.
3 Total concentration includes direct modeled impact and background concentration; annual background NO_2 concentration = 3.4 $\mu g/m^3$.

Table F-27 Summary of Maximum Modeled Cumulative SO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources for Comparison to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[2]

		Bridger Wilderness Class I						Fitzpatrick Wilderness Class I						Popo Agie Wilderness Class II						Wind River Roadless Area Class II					
		Direct Modeled Impact			Total Concentration[3]			Direct Modeled Impact			Total Concentration[1,2]			Direct Modeled Impact			Total Concentration[3]			Direct Modeled Impact			Total Concentration[3]		
Alternative or Development Phase	WDR	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Amual
No Action	--	0.16	0.04	0.00	132.16	43.04	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.16	0.04	0.00	132.16	43.04	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	0.24	0.08	0.00	132.24	43.08	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.08	0.01	0.00	132.08	43.01	9.00	0.12	0.01	0.00	132.12	43.01	9.00
Alternative A	150	0.17	0.05	0.00	132.17	43.05	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.06	0.01	0.00	132.06	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
	75	0.17	0.04	0.00	132.17	43.04	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.03	0.01	0.00	132.03	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
Alternative B	250	0.29	0.10	0.00	132.29	43.10	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.10	0.02	0.00	132.10	43.02	9.00	0.12	0.02	0.00	132.12	43.02	9.00
	150	0.19	0.06	0.00	132.19	43.06	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
	75	0.17	0.04	0.00	132.17	43.04	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.03	0.01	0.00	132.03	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
Alternative C	250	0.24	0.08	0.00	132.24	43.08	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.08	0.01	0.00	132.08	43.01	9.00	0.12	0.01	0.00	132.12	43.01	9.00
	150	0.17	0.05	0.00	132.17	43.05	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.06	0.01	0.00	132.06	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
	75	0.17	0.04	0.00	132.17	43.04	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.03	0.01	0.00	132.03	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	0.27	0.09	0.00	132.27	43.09	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.09	0.02	0.00	132.09	43.02	9.00	0.12	0.01	0.00	132.12	43.01	9.00
	150	0.17	0.06	0.00	132.17	43.06	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.06	0.01	0.00	132.06	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
	75	0.17	0.04	0.00	132.17	43.04	9.00	0.02	0.01	0.00	132.02	43.01	9.00	0.03	0.01	0.00	132.03	43.01	9.00	0.11	0.01	0.00	132.11	43.01	9.00
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

1 Ambient Air Quality Standards: 3-hr NAAQS/WAAQS = 1,300 μg/m^3; 24-hr NAAQS/WAAQS = 365 μg/m^3 (NAAQS) and 260 μg/m^3 (WAAQS); Annual NAAQS/WAAQS = 100 μg/m^3 80 (NAAQS) and 60 μg/m^3 (WAAQS).
2 In μg/m^3.
3 Total concentration includes direct modeled impact and background concentration; annual background SO_2 concentration = 9 μg/m^3; 8-hr background SO_2 concentration = 43 μg/m^3; 3-hr background SO_2 concentration = 132 μg/m^3.

Table F-27 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I						Teton Wilderness Class I						Yellowstone National Park Class I						Washakie Wilderness Area Class I					
		Direct Modeled Impact			Total Concentration[3]			Direct Modeled Impact			Total Concentration[1,2]			Direct Modeled Impact			Total Concentration[3]			Direct Modeled Impact			Total Concentration[3]		
		3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Amual
No Action	--	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
Alternative A	150	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	75	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
Alternative B	250	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	150	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	75	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
Alternative C	250	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	150	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	75	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	150	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
	75	0.20	0.04	0.01	132.20	43.04	9.01	0.04	0.01	0.00	132.04	43.01	9.00	0.07	0.01	0.00	132.07	43.01	9.00	0.02	0.01	0.00	132.02	43.01	9.00
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

1 Ambient Air Quality Standards: 3-hr NAAQS/WAAQS = 1,300 μg/m^3; 24-hr NAAQS/WAAQS = = 365 μg/m^3 (NAAQS) and 260 μg/m^3 (WAAQS); Annual NAAQS/WAAQS = 100 μg/m^3 80 (NAAQS) and 60 μg/m^3 (WAAQS).
2 In μg/m^3.
3 Total concentration includes direct modeled impact and background concentration; annual background SO_2 concentration = 9 μg/m^3; 8-hr background SO_2 concentration = 43 μg/m^3; 3-hr background SO_2 concentration = 132 μg/m^3.

Table F-28 Summary of Maximum Modeled Cumulative PM_{10} Concentration Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources Compared to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[2]

		Bridger Wilderness Class I				Fitzpatrick Wilderness Class I				Popo Agie Wilderness Class II				Wind River Roadless Area Class II			
		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]	
Alternative or Development Phase	WDR	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	0.46	0.018	33.46	16.02	0.13	0.005	33.13	16.00	0.14	0.008	33.14	16.01	0.21	0.009	33.21	16.01
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.91	0.047	33.91	16.05	0.15	0.008	33.15	16.01	0.20	0.015	33.20	16.01	0.23	0.014	33.23	16.01
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	1.82	0.081	34.82	16.08	0.20	0.011	33.20	16.01	0.31	0.024	33.31	16.02	0.29	0.021	33.29	16.02
Alternative A	150	1.45	0.067	34.45	16.07	0.17	0.010	33.17	16.01	0.27	0.020	33.27	16.02	0.27	0.018	33.27	16.02
	75	1.16	0.057	34.16	16.06	0.16	0.009	33.16	16.01	0.24	0.017	33.24	16.02	0.25	0.016	33.25	16.02
Alternative B	250	1.87	0.086	34.87	16.09	0.22	0.012	33.22	16.01	0.30	0.026	33.30	16.03	0.30	0.022	33.30	16.02
	150	1.48	0.071	34.48	16.07	0.18	0.010	33.18	16.01	0.26	0.021	33.26	16.02	0.27	0.019	33.27	16.02
	75	1.16	0.058	34.16	16.06	0.16	0.009	33.16	16.01	0.23	0.018	33.23	16.02	0.25	0.016	33.25	16.02
Alternative C	250	1.40	0.063	34.40	16.06	0.18	0.010	33.18	16.01	0.23	0.020	33.23	16.02	0.28	0.017	33.28	16.02
	150	1.03	0.050	34.03	16.05	0.17	0.008	33.17	16.01	0.20	0.016	33.20	16.02	0.26	0.015	33.26	16.01
	75	0.75	0.040	33.75	16.04	0.16	0.007	33.16	16.01	0.18	0.013	33.18	16.01	0.24	0.013	33.24	16.01
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	1.82	0.081	34.82	16.08	0.21	0.011	33.21	16.01	0.30	0.024	33.30	16.02	0.29	0.021	33.29	16.02
	150	1.47	0.069	34.47	16.07	0.18	0.010	33.18	16.01	0.27	0.020	33.27	16.02	0.27	0.018	33.27	16.02
	75	1.20	0.059	34.20	16.06	0.16	0.009	33.16	16.01	0.24	0.018	33.24	16.02	0.25	0.016	33.25	16.02
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 150 $\mu g/m^3$; Annual NAAQS/WAAQS = 50 $\mu g/m^3$.
2 In $\mu g/m^3$.
3 Total concentration includes direct modeled impact and background concentration; annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.

Table F-28 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I				Teton Wilderness Class I				Yellowstone National Park Class I				Washakie Wilderness Area Class I			
		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	0.12	0.012	33.12	16.01	0.04	0.005	33.04	16.00	0.05	0.004	33.05	16.00	0.04	0.003	33.04	16.00
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.13	0.013	33.13	16.01	0.05	0.006	33.05	16.01	0.05	0.004	33.05	16.00	0.05	0.004	33.05	16.00
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.14	0.015	33.14	16.02	0.08	0.007	33.08	16.01	0.06	0.005	33.06	16.00	0.09	0.005	33.09	16.00
Alternative A	150	0.13	0.014	33.13	16.01	0.07	0.006	33.07	16.01	0.06	0.005	33.06	16.00	0.07	0.004	33.07	16.00
	75	0.13	0.014	33.13	16.01	0.06	0.006	33.06	16.01	0.05	0.004	33.05	16.00	0.06	0.004	33.06	16.00
Alternative B	250	0.15	0.015	33.15	16.02	0.08	0.007	33.08	16.01	0.07	0.005	33.07	16.00	0.10	0.005	33.10	16.01
	150	0.13	0.015	33.13	16.01	0.07	0.006	33.07	16.01	0.06	0.005	33.06	16.00	0.08	0.005	33.08	16.00
	75	0.13	0.014	33.13	16.01	0.06	0.006	33.06	16.01	0.05	0.004	33.05	16.00	0.06	0.004	33.06	16.00
Alternative C	250	0.14	0.015	33.14	16.01	0.07	0.006	33.07	16.01	0.06	0.005	33.06	16.00	0.08	0.005	33.08	16.00
	150	0.13	0.014	33.13	16.01	0.06	0.006	33.06	16.01	0.05	0.004	33.05	16.00	0.06	0.004	33.06	16.00
	75	0.13	0.013	33.13	16.01	0.05	0.006	33.05	16.01	0.05	0.004	33.05	16.00	0.05	0.004	33.05	16.00
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.14	0.015	33.14	16.02	0.08	0.007	33.08	16.01	0.06	0.005	33.06	16.00	0.09	0.005	33.09	16.00
	150	0.13	0.014	33.13	16.01	0.07	0.006	33.07	16.01	0.06	0.005	33.06	16.00	0.08	0.004	33.08	16.00
	75	0.13	0.014	33.13	16.01	0.06	0.006	33.06	16.01	0.05	0.004	33.05	16.00	0.06	0.004	33.06	16.00
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 150 $\mu g/m^3$; Annual NAAQS/WAAQS = 50 $\mu g/m^3$.
2 In $\mu g/m^3$.
3 Total concentration includes direct modeled impact and background concentration; annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.

Table F-29 Summary of Maximum Modeled Cumulative $PM_{2.5}$ Concentrations at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources Compared to Ambient Air Quality Standards[1], Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[2]

		Bridger Wilderness Class I				Fitzpatrick Wilderness Class I				Popo Agie Wilderness Class II				Wind River Roadless Area Class II			
		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]	
Alternative or Development Phase	WDR	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	0.43	0.019	13.43	5.02	0.12	0.006	13.12	5.01	0.13	0.009	13.13	5.01	0.19	0.010	13.19	5.01
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.91	0.048	13.91	5.05	0.14	0.008	13.14	5.01	0.20	0.016	13.20	5.02	0.22	0.015	13.22	5.02
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	1.82	0.081	14.82	5.08	0.20	0.012	13.20	5.01	0.31	0.026	13.31	5.03	0.28	0.022	13.28	5.02
Alternative A	150	1.45	0.068	14.45	5.07	0.17	0.011	13.17	5.01	0.27	0.022	13.27	5.02	0.26	0.019	13.26	5.02
	75	1.15	0.058	14.15	5.06	0.16	0.009	13.16	5.01	0.23	0.019	13.23	5.02	0.24	0.017	13.24	5.02
Alternative B	250	1.87	0.087	14.87	5.09	0.22	0.013	13.22	5.01	0.30	0.028	13.30	5.03	0.29	0.023	13.29	5.02
	150	1.48	0.071	14.48	5.07	0.18	0.011	13.18	5.01	0.26	0.023	13.26	5.02	0.26	0.020	13.26	5.02
	75	1.15	0.059	14.15	5.06	0.16	0.010	13.16	5.01	0.23	0.020	13.23	5.02	0.24	0.017	13.24	5.02
Alternative C	250	1.40	0.064	14.40	5.06	0.18	0.011	13.18	5.01	0.23	0.023	13.23	5.02	0.27	0.018	13.27	5.02
	150	1.03	0.051	14.03	5.05	0.16	0.009	13.16	5.01	0.19	0.019	13.19	5.02	0.25	0.016	13.25	5.02
	75	0.75	0.041	13.75	5.04	0.15	0.008	13.15	5.01	0.17	0.015	13.17	5.02	0.23	0.014	13.23	5.01
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	1.81	0.082	14.81	5.08	0.21	0.012	13.21	5.01	0.30	0.027	13.30	5.03	0.29	0.022	13.29	5.02
	150	1.47	0.070	14.47	5.07	0.17	0.011	13.17	5.01	0.27	0.023	13.27	5.02	0.26	0.020	13.26	5.02
	75	1.19	0.060	14.19	5.06	0.16	0.010	13.16	5.01	0.24	0.020	13.24	5.02	0.24	0.018	13.24	5.02
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

1 Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 65 $\mu g/m^3$; Annual NAAQS/WAAQS = 15 $\mu g/m^3$; the WAAQS are not yet enforced in Wyoming per WAQSR Chapter 2, Section 2(b)(v).
2 In $\mu g/m^3$.
3 Total concentration includes direct modeled impact and background concentration; annual background $PM_{2.5}$ concentration = 5 $\mu g/m^3$; 24-hr background $PM_{2.5}$ concentration = 13 $\mu g/m^3$.

Table F-29 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I				Teton Wilderness Class I				Yellowstone National Park Class I				Washakie Wilderness Area Class I			
		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]		Direct Modeled Impact		Total Concentration[3]	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	0.11	0.013	13.11	5.01	0.04	0.005	13.04	5.01	0.04	0.004	13.04	5.00	0.04	0.004	13.04	5.00
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.13	0.013	33.13	16.01	0.05	0.006	33.05	16.01	0.05	0.004	33.05	16.00	0.05	0.004	33.05	16.00
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.14	0.015	13.14	5.02	0.08	0.007	13.08	5.01	0.06	0.005	13.06	5.01	0.09	0.005	13.09	5.01
Alternative A	150	0.13	0.015	13.13	5.01	0.06	0.006	13.06	5.01	0.06	0.005	13.06	5.00	0.07	0.005	13.07	5.00
	75	0.12	0.014	13.12	5.01	0.06	0.006	13.06	5.01	0.05	0.005	13.05	5.00	0.06	0.005	13.06	5.00
Alternative B	250	0.15	0.016	13.15	5.02	0.08	0.007	13.08	5.01	0.07	0.005	13.07	5.01	0.10	0.006	13.10	5.01
	150	0.13	0.015	13.13	5.02	0.07	0.007	13.07	5.01	0.06	0.005	13.06	5.00	0.08	0.005	13.08	5.00
	75	0.12	0.014	13.12	5.01	0.06	0.006	13.06	5.01	0.05	0.005	13.05	5.00	0.06	0.005	13.06	5.00
Alternative C	250	0.13	0.015	13.13	5.02	0.07	0.007	13.07	5.01	0.06	0.005	13.06	5.00	0.08	0.005	13.08	5.01
	150	0.12	0.014	13.12	5.01	0.06	0.006	13.06	5.01	0.05	0.005	13.05	5.00	0.06	0.005	13.06	5.00
	75	0.12	0.014	13.12	5.01	0.05	0.006	13.05	5.01	0.05	0.004	13.05	5.00	0.05	0.004	13.05	5.00
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.14	0.016	13.14	5.02	0.08	0.007	13.08	5.01	0.06	0.005	13.06	5.01	0.09	0.005	13.09	5.01
	150	0.13	0.015	13.13	5.01	0.07	0.007	13.07	5.01	0.06	0.005	13.06	5.00	0.08	0.005	13.08	5.00
	75	0.12	0.014	13.12	5.01	0.06	0.006	13.06	5.01	0.05	0.005	13.05	5.00	0.06	0.005	13.06	5.00
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] Ambient Air Quality Standards: 24-hr NAAQS/WAAQS = 65 μg/m^3; Annual NAAQS/WAAQS = 15 μg/m^3; the WAAQS are not yet enforced in Wyoming per WAQSR Chapter 2, Section 2(b)(v).
[2] In μg/m^3.
[3] Total concentration includes direct modeled impact and background concentration; annual background $PM_{2.5}$ concentration = 5 μg/m^3; 24-hr background $PM_{2.5}$ concentration = 13 μg/m^3.

Table F-30 Summary of Maximum Modeled Cumulative NO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas Compared to Applicable PSD Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Alternative or Development Phase	WDR	Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
		Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment	Direct Modeled Impact Annual	PSD Increment
No Action[2]	--	0.119	2.5	0.011	2.5	0.027	25	0.024	25	0.029	2.5	0.007	2.5	0.003	2.5	0.009	2.5
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.143	2.5	0.012	2.5	0.036	25	0.030	25	0.029	2.5	0.007	2.5	0.003	2.5	0.010	2.5
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.245	2.5	0.017	2.5	0.070	25	0.051	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
Alternative A	150	0.203	2.5	0.015	2.5	0.057	25	0.043	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	75	0.170	2.5	0.014	2.5	0.047	25	0.036	25	0.029	2.5	0.007	2.5	0.003	2.5	0.010	2.5
Alternative B	250	0.265	2.5	0.017	2.5	0.076	25	0.055	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	150	0.216	2.5	0.016	2.5	0.060	25	0.045	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	75	0.175	2.5	0.014	2.5	0.049	25	0.037	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
Alternative C	250	0.233	2.5	0.016	2.5	0.067	25	0.048	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	150	0.192	2.5	0.015	2.5	0.054	25	0.041	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	75	0.159	2.5	0.013	2.5	0.044	25	0.034	25	0.029	2.5	0.007	2.5	0.003	2.5	0.010	2.5
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.254	2.5	0.017	2.5	0.072	25	0.052	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	150	0.209	2.5	0.015	2.5	0.058	25	0.044	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
	75	0.176	2.5	0.014	2.5	0.049	25	0.038	25	0.030	2.5	0.007	2.5	0.003	2.5	0.010	2.5
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In $\mu g/m^3$. Annual background NO_X concentration = 3.4 $\mu g/m^3$.

Table F-31 Summary of Maximum Modeled Cumulative SO_2 Concentrations at PSD Class I and Sensitive PSD Class II Areas Compared to Applicable PSD Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

		Bridger Wilderness Class I						Fitzpatrick Wilderness Class I						Popo Agie Wilderness Class II						Wind River Roadless Area Class II					
		Direct Modeled Impact			PSD Increment			Direct Modeled Impact			PSD Increment			Direct Modeled Impact			PSD Increment			Direct Modeled Impact			PSD Increment		
Alternative or Development Phase	WDR	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action	--	0.16	0.04	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.02	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.16	0.04	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.02	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	0.24	0.08	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.08	0.01	0.00	512	91	20	0.12	0.01	0.00	512	91	20
Alternative A	150	0.17	0.05	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.06	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
	75	0.17	0.04	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.03	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
Alternative B	250	0.29	0.10	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.10	0.02	0.00	512	91	20	0.12	0.02	0.00	512	91	20
	150	0.19	0.06	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.07	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
	75	0.17	0.04	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.03	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
Alternative C	250	0.24	0.08	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.08	0.01	0.00	512	91	20	0.12	0.01	0.00	512	91	20
	150	0.17	0.05	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.06	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
	75	0.17	0.04	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.03	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	0.27	0.09	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.09	0.02	0.00	512	91	20	0.12	0.01	0.00	512	91	20
	150	0.17	0.06	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.06	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
	75	0.17	0.04	0.00	25	5	2	0.02	0.01	0.00	25	5	2	0.03	0.01	0.00	512	91	20	0.11	0.01	0.00	512	91	20
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

[1] In $\mu g/m^3$. Annual background SO_2 concentration = 9 $\mu g/m^3$; 8-hr background SO_2 concentration = 43 $\mu g/m^3$; 3-hr background SO_2 concentration = 132 $\mu g/m^3$.

Table F-31 (continued)

Alternative or Development Phase	WDR	Grand Teton National Park Class I						Teton Wilderness Class I						Yellowstone National Park Class I						Washakie Wilderness Area Class I					
		Direct Modeled Impact			PSD Increment			Direct Modeled Impact			PSD Increment			Direct Modeled Impact			PSD Increment			Direct Modeled Impact			PSD Increment		
		3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual
No Action	--	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
Alternative A	150	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	75	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
Alternative B	250	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	150	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	75	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
Alternative C	250	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	150	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	75	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	150	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
	75	0.20	0.04	0.01	25	5	2	0.04	0.01	0.00	25	5	2	0.07	0.01	0.00	25	5	2	0.02	0.01	0.00	25	5	2
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

[1] In $\mu g/m^3$. Annual background SO_2 concentration = 9 $\mu g/m^3$; 8-hr background SO_2 concentration = 43 $\mu g/m^3$; 3-hr background SO_2 concentration = 132 $\mu g/m^3$.

Table F-32 Summary of Maximum Modeled Cumulative PM_{10} Concentrations at PSD Class I and Sensitive PSD Class II Areas Compared to Applicable PSD Increments, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Alternative or Development Phase	WDR	Bridger Wilderness Class I				Fitzpatrick Wilderness Class I				Popo Agie Wilderness Class II				Wind River Roadless Area Class II			
		Direct Modeled Impact		PSD Increment		Direct Modeled Impact		PSD Increment		Direct Modeled Impact		PSD Increment		Direct Modeled Impact		PSD Increment	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	0.46	0.018	8	4	0.13	0.005	8	4	0.14	0.008	30	17	0.21	0.009	30	17
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.91	0.047	8	4	0.15	0.008	8	4	0.20	0.015	30	17	0.23	0.014	30	17
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	1.82	0.081	8	4	0.20	0.011	8	4	0.31	0.024	30	17	0.29	0.021	30	17
Alternative A	150	1.45	0.067	8	4	0.17	0.010	8	4	0.27	0.020	30	17	0.27	0.018	30	17
	75	1.16	0.057	8	4	0.16	0.009	8	4	0.24	0.017	30	17	0.25	0.016	30	17
Alternative B	250	1.87	0.086	8	4	0.22	0.012	8	4	0.30	0.026	30	17	0.30	0.022	30	17
	150	1.48	0.071	8	4	0.18	0.010	8	4	0.26	0.021	30	17	0.27	0.019	30	17
	75	1.16	0.058	8	4	0.16	0.009	8	4	0.23	0.018	30	17	0.25	0.016	30	17
Alternative C	250	1.40	0.063	8	4	0.18	0.010	8	4	0.23	0.020	30	17	0.28	0.017	30	17
	150	1.03	0.050	8	4	0.17	0.008	8	4	0.20	0.016	30	17	0.26	0.015	30	17
	75	0.75	0.040	8	4	0.16	0.007	8	4	0.18	0.013	30	17	0.24	0.013	30	17
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	1.82	0.081	8	4	0.21	0.011	8	4	0.30	0.024	30	17	0.29	0.021	30	17
	150	1.47	0.069	8	4	0.18	0.010	8	4	0.27	0.020	30	17	0.27	0.018	30	17
	75	1.20	0.059	8	4	0.16	0.009	8	4	0.24	0.018	30	17	0.25	0.016	30	17
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In $\mu g/m^3$. Annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.

Table F-32 (continued)

Alternative or Development Phase	WDR	Bridger Wilderness Class I				Fitzpatrick Wilderness Class I				Popo Agie Wilderness Class II				Wind River Roadless Area Class II			
		Direct Modeled Impact		PSD Increment		Direct Modeled Impact		PSD Increment		Direct Modeled Impact		PSD Increment		Direct Modeled Impact		PSD Increment	
		24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	0.12	0.012	8	4	0.04	0.005	8	4	0.05	0.004	8	4	0.04	0.003	8	4
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	0.13	0.013	8	4	0.05	0.006	8	4	0.05	0.004	8	4	0.05	0.004	8	4
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	0.14	0.015	8	4	0.08	0.007	8	4	0.06	0.005	8	4	0.09	0.005	8	4
Alternative A	150	0.13	0.014	8	4	0.07	0.006	8	4	0.06	0.005	8	4	0.07	0.004	8	4
	75	0.13	0.014	8	4	0.06	0.006	8	4	0.05	0.004	8	4	0.06	0.004	8	4
Alternative B	250	0.15	0.015	8	4	0.08	0.007	8	4	0.07	0.005	8	4	0.10	0.005	8	4
	150	0.13	0.015	8	4	0.07	0.006	8	4	0.06	0.005	8	4	0.08	0.005	8	4
	75	0.13	0.014	8	4	0.06	0.006	8	4	0.05	0.004	8	4	0.06	0.004	8	4
Alternative C	250	0.14	0.015	8	4	0.07	0.006	8	4	0.06	0.005	8	4	0.08	0.005	8	4
	150	0.13	0.014	8	4	0.06	0.006	8	4	0.05	0.004	8	4	0.06	0.004	8	4
	75	0.13	0.013	8	4	0.05	0.006	8	4	0.05	0.004	8	4	0.05	0.004	8	4
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	0.14	0.015	8	4	0.08	0.007	8	4	0.06	0.005	8	4	0.09	0.005	8	4
	150	0.13	0.014	8	4	0.07	0.006	8	4	0.06	0.005	8	4	0.08	0.004	8	4
	75	0.13	0.014	8	4	0.06	0.006	8	4	0.05	0.004	8	4	0.06	0.004	8	4
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In $\mu g/m^3$. Annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$.

Table F-33 Summary of Maximum Modeled Cumulative Visibility Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources Using FLAG Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv
No Action	--	1.69	3	0.42	0	0.50	0	0.73	0	0.33	0	0.14	0	0.15	0	0.17	0
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	1.98	4	0.48	0	0.57	0	0.82	0	0.34	0	0.16	0	0.17	0	0.20	0
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	3.65	11	0.76	0	0.85	0	1.08	1	0.50	0	0.23	0	0.25	0	0.34	0
Alternative A	150	2.89	9	0.62	0	0.74	0	0.98	0	0.41	0	0.20	0	0.21	0	0.28	0
	75	2.33	4	0.52	0	0.66	0	0.90	0	0.36	0	0.18	0	0.18	0	0.24	0
Alternative B	250	3.81	15	0.82	0	0.90	0	1.12	2	0.54	0	0.24	0	0.27	0	0.37	0
	150	2.99	11	0.65	0	0.77	0	1.00	1	0.43	0	0.21	0	0.22	0	0.30	0
	75	2.38	5	0.53	0	0.68	0	0.90	0	0.36	0	0.18	0	0.18	0	0.25	0
Alternative C	250	3.27	11	0.71	0	0.83	0	1.06	1	0.47	0	0.22	0	0.24	0	0.32	0
	150	2.56	8	0.57	0	0.72	0	0.95	0	0.38	0	0.20	0	0.19	0	0.27	0
	75	2.22	4	0.51	0	0.64	0	0.87	0	0.36	0	0.17	0	0.17	0	0.23	0
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	3.73	14	0.78	0	0.87	0	1.11	1	0.51	0	0.24	0	0.26	0	0.35	0
	150	2.97	10	0.63	0	0.76	0	0.99	0	0.42	0	0.21	0	0.21	0	0.29	0
	75	2.39	6	0.53	0	0.68	0	0.91	0	0.36	0	0.18	0	0.18	0	0.25	0
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In deciviews (dv).

Table F-34 Summary of Maximum Modeled Cumulative Visibility Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources Using IMPROVE Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Bridger Wilderness Class I		Fitzpatrick Wilderness Class I		Popo Agie Wilderness Class II		Wind River Roadless Area Class II		Grand Teton National Park Class I		Teton Wilderness Class I		Yellowstone National Park Class I		Washakie Wilderness Area Class I	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv	Maximum Visibility Impact[1]	Number of Days >1.0 dv
No Action	--	1.94	3	0.49	0	0.58	0	0.81	0	0.33	0	0.14	0	0.16	0	0.17	0
MAXIMUM PRODUCTION EMISSIONS																	
All alternatives with 3,100 wells	0	2.26	4	0.56	0	0.66	0	0.92	0	0.35	0	0.16	0	0.17	0	0.20	0
MAXIMUM FIELD EMISSIONS																	
Alternative A and Proposed Action	250	4.01	17	0.87	0	0.99	0	1.21	2	0.50	0	0.24	0	0.25	0	0.34	0
Alternative A	150	3.19	9	0.71	0	0.86	0	1.09	2	0.41	0	0.21	0	0.21	0	0.29	0
	75	2.65	7	0.61	0	0.77	0	1.00	0	0.36	0	0.18	0	0.18	0	0.24	0
Alternative B	250	4.18	19	0.95	0	1.04	2	1.25	2	0.54	0	0.25	0	0.27	0	0.37	0
	150	3.30	9	0.76	0	0.90	0	1.11	2	0.44	0	0.21	0	0.22	0	0.30	0
	75	2.71	7	0.61	0	0.78	0	1.01	1	0.36	0	0.18	0	0.18	0	0.25	0
Alternative C	250	3.60	13	0.82	0	0.96	0	1.18	2	0.47	0	0.23	0	0.24	0	0.32	0
	150	2.92	7	0.66	0	0.83	0	1.06	1	0.38	0	0.20	0	0.20	0	0.27	0
	75	2.53	4	0.59	0	0.74	0	0.97	0	0.36	0	0.17	0	0.17	0	0.23	0
Alternative D	250																
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.															
	75																
Alternative E	250																
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.															
	75																
Alternative F	250	4.10	17	0.90	0	1.00	1	1.23	2	0.52	0	0.24	0	0.26	0	0.36	0
	150	3.27	9	0.73	0	0.88	0	1.11	2	0.43	0	0.21	0	0.21	0	0.29	0
	75	2.72	7	0.62	0	0.78	0	1.01	1	0.37	0	0.19	0	0.18	0	0.25	0
Alternative G	250																
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.															
	75																
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.															

[1] In deciviews (dv).

Table F-35 Summary of Maximum Modeled Cumulative Change in ANC at Acid Sensitive Lakes from Direct Project and Regional Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Black Joe Lake - Bridger Wilderness Class I		Deep Lake - Bridger Wilderness Class I		Hobbs Lake - Bridger Wilderness Class I		Lazy Boy Lake - Bridger Wilderness Class I		Upper Frozen Lake - Bridger Wilderness Class I		Lower Saddlebag - Popo Agie Wilderness Class II		Ross Lake - Fitzpatrick Wilderness Class I	
Alternative or Development Phase	WDR	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change	ANC Change[1]	Percent ANC Change
Background ANC	--	67.0	--	59.9	--	69.9	--	18.8	--	5.0	--	55.5	--	53.5	--
Level of Acceptable Change (µeq/L)	--	6.70	--	5.99	--	6.99	--	1.00	--	1.00	--	5.55	--	5.35	--
No Action	--	0.085	0.13	0.087	0.14	0.042	0.06	0.025	0.13	0.091	1.83	0.096	0.17	0.026	0.05
MAXIMUM PRODUCTION EMISSIONS															
All alternatives with 3,100 wells	0	0.107	0.16	0.111	0.18	0.046	0.07	0.026	0.14	0.120	2.39	0.122	0.22	0.027	0.05
MAXIMUM FIELD EMISSIONS															
Alternative A and Proposed Action	250	0.185	0.28	0.196	0.33	0.062	0.09	0.032	0.17	0.227	4.53	0.220	0.40	0.032	0.06
Alternative A	150	0.156	0.23	0.164	0.27	0.056	0.08	0.030	0.16	0.187	3.73	0.183	0.33	0.030	0.06
	75	0.132	0.20	0.137	0.23	0.051	0.07	0.028	0.15	0.153	3.06	0.154	0.28	0.029	0.05
Alternative B	250	0.199	0.30	0.211	0.35	0.065	0.09	0.032	0.17	0.246	4.92	0.237	0.43	0.033	0.06
	150	0.164	0.24	0.173	0.29	0.057	0.08	0.030	0.16	0.198	3.97	0.193	0.35	0.031	0.06
	75	0.137	0.20	0.142	0.24	0.051	0.07	0.028	0.15	0.159	3.17	0.160	0.29	0.029	0.05
Alternative C	250	0.177	0.26	0.186	0.31	0.061	0.09	0.031	0.17	0.215	4.31	0.212	0.38	0.032	0.06
	150	0.147	0.22	0.154	0.26	0.054	0.08	0.029	0.16	0.175	3.50	0.175	0.31	0.030	0.06
	75	0.124	0.18	0.128	0.21	0.049	0.07	0.028	0.15	0.142	2.84	0.146	0.26	0.028	0.05
Alternative D	250														
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.													
	75														
Alternative E	250														
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.													
	75														
Alternative F	250	0.190	0.28	0.202	0.34	0.063	0.09	0.032	0.17	0.234	4.67	0.226	0.41	0.033	0.06
	150	0.159	0.24	0.168	0.28	0.057	0.08	0.030	0.16	0.192	3.84	0.188	0.34	0.031	0.06
	75	0.137	0.20	0.142	0.24	0.052	0.07	0.028	0.15	0.160	3.20	0.160	0.29	0.029	0.05
Alternative G	250														
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.													
	75														
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.													

[1] In µeq/L.

Table F-36 Summary of Modeled Cumulative Sulfur (S) Deposition Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Alternative or Development Phase	WDR	Bridger Wilderness Class I	Fitzpatrick Wilderness Class I	Popo Agie Wilderness Class II	Wind River Roadless Area Class II	Grand Teton National Park Class I	Teton Wilderness Class I	Yellowstone National Park Class I	Washakie Wilderness Area Class I
No Action	--	-0.001	-0.001	-0.003	-0.001	0.003	0.001	0.001	0.000
MAXIMUM PRODUCTION EMISSIONS									
All alternatives with 3,100 wells	0	-0.001	-0.001	-0.003	-0.001	0.003	0.001	0.001	0.000
MAXIMUM FIELD EMISSIONS									
Alternative A and Proposed Action	250	-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
Alternative A	150	-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
Alternative B	250	-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
Alternative C	250	-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
75		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
Alternative D 150	250								
75	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.							
Alternative E 150	250								
75	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.							
Alternative F	250	-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
75		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
		-0.001	-0.001	-0.002	-0.001	0.003	0.001	0.001	0.000
Alternative G	250								
75	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.							
Preferred Alternative 150 75	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.							

[1] In kg/ha-yr. Sulfur deposition analysis level of concern for cumulative impacts = 5.0 kg/ha-hr.

75

Table F-37 Summary of Modeled Cumulative Far-field Nitrogen Deposition Impacts at PSD Class I and Sensitive PSD Class II Areas from Direct Project and Regional Sources, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

Alternative or Development Phase	WDR	Bridger Wilderness Class I	Fitzpatrick Wilderness Class I	Popo Agie Wilderness Class II	Wind River Roadless Area Class II	Grand Teton National Park Class I	Teton Wilderness Class I	Yellowstone National Park Class I	Washakie Wilderness Area Class I
No Action	--	0.030	0.005	0.012	0.011	0.009	0.003	0.002	0.003
MAXIMUM PRODUCTION EMISSIONS									
All alternatives with 3,100 wells	0	0.035	0.006	0.016	0.013	0.009	0.003	0.002	0.004
MAXIMUM FIELD EMISSIONS									
Alternative A and Proposed Action	250	0.057	0.008	0.029	0.021	0.010	0.004	0.003	0.004
Alternative A	150	0.048	0.007	0.024	0.018	0.010	0.003	0.003	0.004
		0.041	0.006	0.020	0.015	0.010	0.003	0.002	0.004
Alternative B	250	0.061	0.008	0.031	0.022	0.011	0.004	0.003	0.004
		0.051	0.007	0.025	0.019	0.010	0.004	0.003	0.004
		0.042	0.007	0.021	0.016	0.010	0.003	0.002	0.004
Alternative C	250	0.055	0.008	0.028	0.020	0.010	0.003	0.003	0.004
75		0.046	0.007	0.023	0.017	0.010	0.003	0.003	0.004
		0.039	0.006	0.019	0.014	0.010	0.003	0.002	0.004
Alternative D 150	250								
75	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.							
Alternative E 150	250								
75	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.							
Alternative F	250	0.059	0.008	0.030	0.021	0.010	0.004	0.003	0.004
75		0.049	0.007	0.025	0.018	0.010	0.003	0.003	0.004
		0.042	0.007	0.021	0.016	0.010	0.003	0.002	0.004
Alternative G	250								
75	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.							
Preferred Alternative 150	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.							
75									

[1] In kg/ha-yr. Nitrogen deposition analysis level of concern for cumulative impacts = 3.0 kg/ha-hr.

75

Table F-38 Summary of Maximum Modeled Visibility Impacts at Wyoming Regional Communities from Direct Project and Regional Sources Using FLAG Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Big Piney		Big Sandy		Boulder		Bronx		Cora		Daniel		Farson		Labarge		Merna		Pinedale	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv
No Action	--	1.91	5	1.27	1	2.56	4	0.66	0	0.74	0	0.68	0	1.33	3	1.62	6	0.88	0	1.55	2
MAXIMUM PRODUCTION EMISSIONS																					
All alternatives with 3,100 wells	0	1.98	7	1.64	4	2.67	5	0.69	0	0.81	0	0.79	0	1.47	6	1.79	6	0.91	0	1.69	4
MAXIMUM FIELD EMISSIONS																					
Alternative A and Proposed Action	250	2.29	16	3.29	31	3.26	19	1.56	1	2.92	6	2.34	6	2.49	11	2.54	9	1.00	0	3.91	8
Alternative A	150	2.09	13	2.60	20	2.89	11	1.15	1	2.18	3	1.74	2	1.99	10	2.27	6	0.96	0	2.98	8
	75	2.04	10	2.06	10	2.78	8	0.80	0	1.49	1	1.20	1	1.73	10	2.04	6	0.94	0	2.07	5
Alternative B	250	2.41	20	3.64	34	3.48	23	1.74	1	3.29	7	2.64	10	2.68	12	2.66	12	1.06	3	4.44	9
	150	2.10	13	2.84	23	2.91	13	1.25	1	2.40	3	1.92	3	2.10	10	2.34	6	0.97	0	3.32	8
	75	2.05	10	2.20	13	2.79	9	0.82	0	1.57	1	1.26	1	1.78	10	2.07	6	0.94	0	2.23	5
Alternative C	250	2.24	15	3.04	23	3.11	16	1.40	1	2.65	5	2.10	4	2.36	10	2.50	9	0.99	0	3.52	8
	150	2.08	12	2.34	15	2.84	10	0.98	0	1.89	1	1.49	1	1.86	10	2.22	6	0.96	0	2.55	6
	75	2.03	8	1.78	8	2.74	6	0.72	0	1.18	1	0.93	0	1.62	9	1.99	6	0.93	0	1.79	4
Alternative D	250																				
		Alternative D was not modeled. Results would be between Alternative A and Alternative C.																			
	75																				
Alternative E	250																				
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																			
	75																				
Alternative F	250	2.37	18	3.41	32	3.36	21	1.63	1	3.06	7	2.45	8	2.59	11	2.60	10	1.00	2	4.10	9
150	150	2.10	13	2.72	23	2.90	12	1.21	1	2.30	3	1.84	3	2.05	10	2.30	6	0.97	0	3.16	8
	75	2.05	10	2.19	13	2.79	9	0.86	0	1.63	1	1.31	1	1.78	10	2.08	6	0.94	0	2.29	5
Alternative G	250																				
		Alternative G was not modeled. Results would be between Alternative A and Alternative F.																			
	75																				
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																			

[1] In deciviews (dv).

150

Table F-39 Summary of Maximum Modeled Cumulative Visibility Impacts at Wyoming Regional Communities from Direct Project and Regional Sources Using IMPROVE Background Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.

		Big Piney		Big Sandy		Boulder		Bronx		Cora		Daniel		Farson		Labarge		Merna		Pinedale	
Alternative or Development Phase	WDR	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv	Maximum Visibility Impact[1]	Number of Days > 1.0 dv
No Action	--	2.18	7	1.45	2	2.92	4	0.74	0	0.85	0	0.79	0	1.48	3	1.86	6	0.98	0	1.78	2
MAXIMUM PRODUCTION EMISSIONS																					
All alternatives with 3,100 wells	0	2.26	11	1.88	9	3.04	5	0.77	0	0.93	0	0.89	0	1.69	8	2.05	6	1.01	1	1.94	5
MAXIMUM FIELD EMISSIONS																					
Alternative A and Proposed Action	250	2.62	20	3.62	34	3.70	21	1.79	1	3.32	8	2.67	11	2.75	12	2.90	12	1.13	5	4.41	10
Alternative A	150	2.39	15	2.88	24	3.28	13	1.32	1	2.49	5	1.99	6	2.26	10	2.59	9	1.07	1	3.38	8
	75	2.33	13	2.28	14	3.17	9	0.92	0	1.71	3	1.38	1	1.98	10	2.33	6	1.05	1	2.37	8
Alternative B	250	2.75	22	4.00	36	3.94	21	1.99	4	3.74	10	3.01	14	2.96	13	3.03	12	1.23	6	5.00	15
	150	2.40	17	3.13	28	3.31	16	1.44	1	2.74	6	2.19	7	2.36	10	2.67	9	1.08	2	3.76	8
	75	2.34	14	2.43	16	3.17	9	0.94	0	1.80	3	1.44	2	2.04	10	2.37	6	1.05	1	2.55	8
Alternative C	250	2.55	18	3.35	30	3.54	18	1.60	1	3.01	7	2.41	9	2.61	11	2.85	11	1.10	4	3.99	8
	150	2.38	14	2.58	18	3.23	10	1.13	1	2.16	5	1.71	4	2.13	10	2.54	7	1.07	1	2.91	8
	75	2.32	13	1.97	9	3.12	7	0.80	0	1.36	1	1.08	1	1.85	10	2.28	6	1.04	1	2.05	5
Alternative D	250																				
		Alternative D was not modeled. Results would be between Alternative A and Alternative C.																			
	75																				
Alternative E	250																				
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																			
	75																				
Alternative F	250	2.70	20	3.75	34	3.80	21	1.87	2	3.48	8	2.80	13	2.86	13	2.96	12	1.16	5	4.63	11
150	150	2.40	16	3.00	25	3.30	14	1.39	1	2.63	6	2.11	6	2.31	10	2.63	10	1.08	1	3.59	8
	75	2.34	14	2.43	16	3.18	9	0.99	0	1.87	3	1.50	2	2.04	10	2.38	6	1.05	1	2.62	8
Alternative G	250																				
		Alternative G was not modeled. Results would be between Alternative A and Alternative F.																			
	75																				
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																			

[1] In deciviews (dv).

150

Table F-40 Summary of Maximum Modeled Cumulative In-field Pollutant Concentrations from Direct Project Sources Compared to Ambient Air Quality Standards (100 mg/m3 NAAQS and WAAQS), Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.[1]

		NO_X			SO_2									PM_{10}						$PM_{2.5}$					
		Direct Modeled Impact	Total Concentration[2]	NAAQS/ WAAQS	Direct Modeled Impact			Total Concentration[2]			NAAQS/WAAQS			Direct Modeled Impact		Total Concentration[2]		NAAQS/WAAQS		Direct Modeled Impact		Total Concentration[2]		NAAQS/WAAQS[3]	
Alternative or Development Phase	WDR	Annual	Annual	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	3-hr	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
No Action	--	1.2	4.6	100	0.7	0.1	0.0	132.7	43.1	9.0	1,300	365/260	80/60	0.3	0.0	33.3	16.0	150	50	0.3	0.0	13.3	5.0	65	15
MAXIMUM PRODUCTION EMISSIONS																									
All alternatives with 3,100 wells	0	3.2	6.6	100	0.7	0.1	0.0	132.7	43.1	9.0	1,300	365/260	80/60	90.5	12.6	123.5	28.6	150	50	16.5	2.0	29.5	7.0	65	15
MAXIMUM FIELD EMISSIONS																									
Alternative A and Proposed Action	250	14.0	17.4	100	18.2	3.6	0.4	150.2	46.6	9.4	1,300	365/260	80/60	113.4	16.0	146.4	32.0	150	50	21.8	3.1	34.8	8.1	65	15
Alternative A	150	12.4	15.8	100	13.9	3.2	0.3	145.9	46.2	9.3	1,300	365/260	80/60	104.0	14.7	137.0	30.7	150	50	19.4	2.9	32.4	7.9	65	15
	75	10.7	14.1	100	13.9	3.2	0.3	145.9	46.2	9.3	1,300	365/260	80/60	97.2	13.8	130.2	29.8	150	50	17.9	2.6	30.9	7.6	65	15
Alternative B	250	16.5	19.9	100	22.4	4.5	0.4	154.4	47.5	9.4	1,300	365/260	80/60	113.8	16.1	146.8	32.1	150	50	22.2	3.3	35.2	8.3	65	15
	150	14.6	18.0	100	17.1	4.0	0.4	149.1	47.0	9.4	1,300	365/260	80/60	104.2	14.8	137.2	30.8	150	50	19.6	3.0	32.6	8.0	65	15
	75	12.2	15.6	100	17.1	4.0	0.3	149.1	47.0	9.3	1,300	365/260	80/60	97.2	13.8	130.2	29.8	150	50	17.9	2.7	30.9	7.7	65	15
Alternative C	250	13.0	16.4	100	18.2	3.6	0.4	150.2	46.6	9.4	1,300	365/260	80/60	59.5	8.6	92.5	24.6	150	50	12.0	2.0	25.0	7.0	65	15
	150	11.3	14.7	100	13.9	3.2	0.3	145.9	46.2	9.3	1,300	365/260	80/60	50.1	7.3	83.1	23.3	150	50	9.7	1.7	22.7	6.7	65	15
	75	9.5	12.9	100	13.9	3.2	0.3	145.9	46.2	9.3	1,300	365/260	80/60	43.2	6.4	76.2	22.4	150	50	8.4	1.5	21.4	6.5	65	15
Alternative D	250																								
	150	Alternative D was not modeled. Results would be between Alternative A and Alternative C.																							
	75																								
Alternative E	250																								
	150	Alternative E was not modeled. Results would be between Alternative B and Alternative F.																							
	75																								
Alternative F	250	16.8	20.2	100	20.2	4.0	0.4	152.2	47.0	9.4	1,300	365/260	80/60	105.7	15.1	138.7	31.1	150	50	20.6	3.2	33.6	8.2	65	15
	150	15.9	19.3	100	15.4	3.6	0.4	147.4	46.6	9.4	1,300	365/260	80/60	104.1	14.9	137.1	30.9	150	50	19.5	3.1	32.5	8.1	65	15
	75	14.6	18.0	100	15.4	3.6	0.3	147.4	46.6	9.3	1,300	365/260	80/60	97.2	14.0	130.2	30.0	150	50	17.9	2.9	30.9	7.9	65	15
Alternative G	250																								
	150	Alternative G was not modeled. Results would be between Alternative A and Alternative F.																							
	75																								
Preferred Alternative	250	Preferred Alternative was not modeled. Results would be similar to Alternative G.																							

[1] In $\mu g/m^3$.
[2] Total concentration includes direct modeled impact, including RFD and RFFA, and background concentration; annual background NO_X concentration = 3.4 $\mu g/m^3$; annual background SO_2 concentration = 9 $\mu g/m^3$; 8-hr background SO_2 concentration = 43 $\mu g/m^3$; 3-hr background SO_2 concentration = 132 $\mu g/m^3$; annual background PM_{10} concentration = 16 $\mu g/m^3$; 24-hr background PM_{10} concentration = 33 $\mu g/m^3$; annual background $PM_{2.5}$ concentration = 5 $\mu g/m^3$; 24-hr background $PM_{2.5}$ concentration = 13 $\mu g/m^3$.
[3] WAAQS for $PM_{2.5}$ are not yet enforced in Wyoming per WAQSR Chapter 2, Section 2(b)(v).

APPENDIX G — JONAH INFILL DRILLING PROJECT DEVELOPMENT PROCEDURES TECHNICAL SUPPORT DOCUMENT

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JONAH INFILL DRILLING PROJECT
DEVELOPMENT PROCEDURES
TECHNICAL SUPPORT DOCUMENT

Prepared for

Bureau of Land Management
Pinedale Field Office
Pinedale, Wyoming
and
Rock Springs Field Office
Rock Springs, Wyoming

and

Jonah Infill Drilling Project Operators
South Piney Natural Gas Development Project Companies

By

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 35982

February 2005

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ACRONYMS AND ABBREVIATIONS

APD	Application for Permit to Drill
AQD	Air Quality Division
BACT	Best Available Control Technologies
bbl	Barrels
BCF	Billion cubic feet
BLM	Bureau of Land Management
CERLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COA	Conditions of Approval
DR	Decision Records
EA	Environmental Assessments
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
JIDPA	Jonah Infill Drilling Project Area
LOP	Life-of-project
LQD	Land Quality Division
mmcf	Million cubic feet
NEPA	*National Environmental Policy Act of 1969*
NTC	Notice to Lessees
Operators	Oil and gas development companies
OSHA	Occupational Safety and Health Administration
OVM	Organic vapor meter
ppm	Parts per million
ROW	Right-of-way
SWPPP	Storm Water Pollution Prevention Plan
SCADA	Supervisory Control and Data Acquisition
TCF	Trillion cubic feet
TDS	Total Dissolved Solids
TRPH	Total recoverable petroleum hydrocarbons

ACRONYMS AND ABBREVIATIONS (CONTINUED)

VOC	Volatile organic compound
WDEQ	Wyoming Department of Environmental Quality
WDOT	Wyoming Department of Transportation
WOGCC	Wyoming Oil and Gas Conservation Commission
WQD	Water Quality Division
WSEO	Wyoming State Engineer's Office

1.0 INTRODUCTION

This technical support document provides a summary of the primary facets for development of the Jonah Infill Drilling Project and includes a Transportation Plan, Reclamation Plan, and Hazardous Materials Summary. These materials are provided in support of the *Jonah Infill Drilling Project Environmental Impact Statement* (EIS) (Bureau of Land Management [BLM] 2004). Where development actions would likely differ among development alternatives (i.e., Proposed Action, Alternatives A-G, and the Preferred Alternative), these differences are identified.

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2.0 PROJECT DEVELOPMENT

Drilling and development operations would continue year-round and may utilize as many as 20 drilling rigs operating in the Jonah Infill Drilling Project Area (JIDPA) simultaneously (the 250 well/year case). The BLM may, however, restrict the pace of development in the area to only 75 or 150 wells developed per year, and in these cases the number of simultaneously operating rigs may be reduced or drilling may not continue year-round.

2.1 TRAFFIC AND WORKFORCE

Workers, material, and equipment would be transported to the JIDPA over U.S. Highway 191, State Highway 351, and BLM Roads 4206 (Burma Road), 5409 (Luman Road) and the Jonah North Road, and most of these trips would likely originate from Rock Springs, Pinedale, Big Piney, or Marbleton, Wyoming. An estimated 810 round trips would be required to construct, drill, complete, and tie in (pipeline construction) each well (Table 2.1). However, where wells would be directionally drilled, drilling traffic would increase by approximately 20% per well (i.e., from 200 trips to 240 trips per well) primarily as a result of increased drilling duration. During production, an estimated maximum of 1,996 round trips per well would be necessary for condensate and water hauling and maintenance (assumes pumpers visit wells every 3 days and an average of 20 wells would be visited daily) (Table 2.1). Some reduction in production traffic and distance traveled may occur as a result of directionally drilled wells since more wells could be visited daily at fewer well pad locations. Additional detail on traffic requirements is provided in the Transportation Plan included as Appendix A of this document.

Construction workers, rig crews, fracturing/completion crews, and support personnel would be primarily housed in Rock Springs, Pinedale, Boulder, Big Piney, Marbleton, La Barge, and Eden/Farson; therefore, no worker camps or temporary housing in the JIDPA are proposed. Table 2.2 provides the estimated work force requirements associated with the project.

Table 2.1 Estimated Traffic Requirements, Jonah Infill Drilling Project, Sublette County, Wyoming.

Type of Traffic	Round Trips per Well	Life-of-Project (LOP) Round Trips Maximum Development (Thousands)[1]	Average Daily Traffic[1]
Well Construction and Development			
Well Pad and Access Road Construction (4 days/well site)[2]	20	62	--
Drilling (22 days)[3]	200	620	--
Completion/Testing (17 days)	570	1,767	--
Pipeline Construction (4 days)	20	62	--
Total well construction and development (54 days/well site)	810	2,511	529
New Production Activities[4]	1,996	6,188	424
Existing Production Activities[4]	--	1,064	73
Total[5]	2,569	9,763	505[5]

1 Assumes 3,100 wells are drilled and completed as producers, wells produce every day, development actions would be completed in 13 years, well life is 40 years, and LOP is 53 years (excludes the final 3 years of reclamation).

2 Includes gravel hauling.

3 Includes rig up/rig down and assumes no directional drilling; directional wells average approximately 26 days to drill.

4 Assumes one pumper can visit 20 wells/day, one pad is visited every 3 days, and average well life is 40 years.

5 Some additional low volume traffic would also be necessary for reclamation activities; average daily traffic volumes are not additive.

Table 2.2 Estimated Work Force Requirements, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Employment Category	Worker-Days per Well	Worker-Years for 1,250 Wells[2]	Worker-Years for 2,200 Wells[2]	Worker-Years for 3,100 Wells[2]
Well Construction and Development				
Well Pad and Access Road Construction (4 days x 4 workers)	16	77	136	191
Rig Up/Down (5 days x 15 workers)	75	361	635	895
Drilling[3] (22 days x 11 workers x 2 shifts)	528	2,539	4,468	6,296
Completion Testing (17 days x 11 workers)	187	900	1,583	2,230
Pipeline Construction (4 days x 6 workers)	24	116	203	287
Production and Maintenance Activities				
Production[4,5]	305	1,767	2,881	3,863
Workovers[6] (every 10 to 20 years) (10 days x 7 workers)	210	1,010	1,777	2,504
Abandonment and Reclamation				
(5 days x 10 workers)	50	241	423	597
Total	1,395	7,011	12,106	16,863

1 Assumes all wells are drilled and completed as producers.
2 260 worker-days = 1 worker-year.
3 Assumes all vertical well drilling.
4 Assumes 1 pumper can visit 20 wells/day, all pads are visited every 3 days, and wells produce for 40 years.
5 Assumes six full-time production foremen and six full-time field clerks in addition to pumpers.
6 Assumes three workovers per well.

Depending upon the number of wells authorized (1,250, 2,200, or 3,100) and the number of wells developed per year (75, 150, or 250), project construction, drilling, completion, and production would require from 43 to 85 years to complete (see EIS Table 2.1). The fewer the number of wells and the faster the pace of development, the shorter the life-of-project (LOP).

Oil and gas development companies (Operators) would comply with existing federal, state, and county requirements and restrictions developed to protect road networks and the traveling public. Special arrangements would be made with the Wyoming Department of Transportation (WDOT), as required, to transport oversized and/or overweight loads to the JIDPA. The transportation planning process for this project is described in Appendix A.

2.2 PRECONSTRUCTION PLANNING AND SITE LAYOUT

Pursuant to *Onshore Oil and Gas Order No. 1*, each proposed well would require an Application for Permit to Drill (APD) approved by BLM prior to any surface disturbance. Each APD would include site-specific information regarding all facets of well development including environmental concerns. Operators and/or their contractors and subcontractors would conduct all phases of project implementation (e.g., wellpad construction, road and pipeline construction, drilling and completion operations, maintenance, reclamation, and abandonment) in full compliance with all applicable federal, state, and county plans, laws, and regulations and according to approved APD specifications, right-of-way (ROW) permits, and site-specific environmental assessments (EAs) and decision records (DRs). Operators would be fully accountable for their contractors' and subcontractors' compliance with the requirements in the approved permits and/or plans.

When development of federal minerals would take place on private surface, Operators would follow *Onshore Oil and Gas Order No. 1* and C.F.R. 43 Subpart 3814 with regard to access for natural gas resource development and remuneration to the landowner for potential damage.

2.3 CONSTRUCTION AND DRILLING OPERATIONS

All activities at each well in the JIDPA would follow procedures approved by the BLM in the APD and attached Conditions of Approval (COAs). Well pad, access road, and other construction activities would follow guidelines set forth in the most recent edition of the "Gold Book," *Surface Operating Standards for Oil and Gas Exploration and Development*, and/or *Manual 9113 – Roads* (BLM 1985) concerning road construction standards on projects subject to federal jurisdiction. Sufficient topsoil to facilitate revegetation would be segregated from subsoils during all construction and would be replaced on the surface upon completion of operations as part of the reclamation and revegetation program. Topsoil stockpiles would be stabilized with vegetation until used for reclamation. Further detail on proposed reclamation activities is provided in the Reclamation Plan, included as Appendix B of this document.

2.4 WELL PADS

Major components of each individual well pad include the following:

- a level drilling area for placement and support of the drilling rig and related equipment, production facilities, and storage tanks;
- an earthen reserve pit to contain drilling fluids, drilled cuttings, and fluids produced during the drilling operation; and
- an earthen flare pit for the safe ignition of flammable gases produced during completion and testing operations.

The entire well pad area would be cleared of all vegetation, and up to 12 inches of topsoil would be removed from all cut, fill, and/or subsoil storage areas. Topsoil would be stockpiled for future use in reclamation. After the topsoil has been removed, the pad would be graded to prepare a level working surface. Each well location would be designed so that the amount of cut and fill material would "balance," where feasible, thereby minimizing the need to stockpile excess subsoil adjacent to the well location until site reclamation. Materials excavated from the reserve pit would be stockpiled adjacent to the reserve pit and used to backfill the pit during reclamation.

The area required for drilling and completion of each well would vary depending upon the type of well being drilled (i.e., vertical or directional), the total number of wells to be developed from the pad, and/or whether new development would occur from an existing pad. In general, new vertical wells would require 3.8-acre pads and directional well pads with multiple wells would require from 5.0 to 10.0 acres.

Well pad and access road construction would take 4 days per location and would require 4 workers (16 worker days) (see Table 2.2). These services would be provided by local contractors.

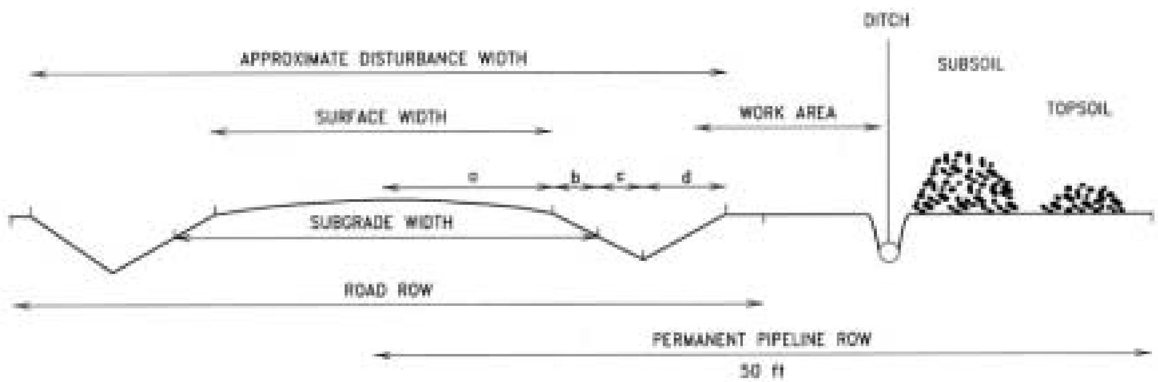
Erosion control would be maintained through prompt revegetation and by constructing surface water drainage controls such as berms, diversion ditches, and sediment ponds as necessary at each well location. All diversion ditches and other surface water and erosion control structures at each location would be shown on topographic relief maps provided with each APD. Storm Water Pollution Prevention Plans (SWPPPs) would be prepared by each Operator for all wells, access roads, and other disturbances of more than 5 acres in compliance with the Wyoming Department of Environmental Quality (WDEQ) requirements (McMurry Oil Company 2003).

2.5 ROADS

New resource road construction would average approximately 0.15 mile for each new well pad. With the inclusion of an adjacent gathering pipeline, 1.3 acres of disturbance would be required initially (73.3-ft initial disturbance width) and 0.5 acre of disturbance would be required for the LOP (29-ft LOP disturbance width). Figure 2.1 provides a typical road with adjacent pipeline schematic.

Roads would be designed by a licensed professional engineer if deemed necessary by the BLM (i.e., in problem areas such as steep slopes, unsuitable soils), and all roads would be built in accordance with guidelines established for oil and gas exploration and development activities in BLM Manual Section 9113 (BLM 1985, 1991a). On completion of construction activities, the

(NOT TO SCALE)



	MINIMUM SUBGRADE WIDTH (ft)	MINIMUM SURFACED TRAVELWAY WIDTH (ft)	a (ft)	b (ft)	c (ft)	d (ft)	APPROXIMATE DISTURBANCE WIDTH (ft)	ROW WIDTH (ft)	DESIGN SPEED (mph)
RESOURCE ROAD	16	12	6	2	4	8	40	50	15–30
LOCAL ROAD	24	20	10	2	4	8	48	55	20–50
COLLECTOR ROAD	28	24	12	2	4	8	52	60	30–50

DIAGRAM OF TYPICAL TURNOUTS ON RESOURCE ROADS

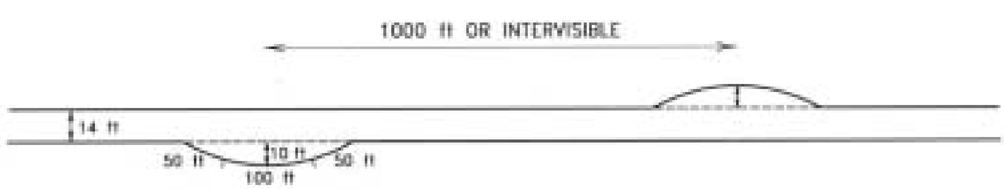


Figure 2.1 Typical Access Road with Adjacent Pipeline Schematic, Jonah Infill Drilling Program, Sublette County, Wyoming, 2004.

engineer would certify that the road was constructed in accordance with the approved road construction design, if deemed necessary by the BLM. Any deficiencies would be corrected to ensure compliance with both the approved Road Construction Plan and the APD. Once resource road construction is complete, all but 29 ft of the ROW (road surface area and portions of borrow ditch) would be reclaimed and revegetated. All road construction, upgrading, maintenance, and road reclamation activities would be implemented in accordance with the Transportation Plan for this project (see Appendix A).

As the existing project has proceeded, various existing lower-volume resource roads have been upgraded to local/collector road conditions (e.g., Jonah North Road), and it is anticipated that these upgrades would be implemented on approximately 8 miles of existing resource roads in the JIDPA for this proposed project. Additionally, the existing Burma Road from the JIDPA north to Wyoming Highway 351 would be upgraded. New or upgraded collector roads in the JIDPA would be developed under all alternatives except No Action, and under Alternative B, only the Burma Road would be upgraded. Approximately 73 acres of new disturbance and 37 acres of LOP disturbance would be required for new in-field collector roads, and approximately 75 acres of new disturbance and 20 acres of LOP disturbance would be required for the Burma Road upgrade. Operators would work with the BLM and the WDOT in establishing the appropriate needs for the Burma Road/Highway 351 junction (e.g., turnouts, paving, new fencing, and culverts).

Aggregates used for road and well location construction would be acquired from commercial sources primarily on federal and state lands on and adjacent to the JIDPA. Prior to aggregate extraction, appropriate permits would be obtained from the BLM and/or WDEQ/Land Quality Division (LQD) and WDEQ/Air Quality Division (AQD), as appropriate. Aggregates would be free of noxious weeds.

2.6 DRILLING OPERATIONS

Gas reserves within the JIDPA are estimated to be 10.5 trillion cubic feet (TCF), and this project is proposed to maximize the recovery of these reserves. Drilling and development activities over the last few years have led to a better understanding of the gas resources beneath the JIDPA, and it has been determined that considerable volumes of gas would be left unrecovered without the development of additional wells (BLM 2002) (Figure 2.2). Map 2.1 shows projected down-hole well spacing for maximum resource recovery. Without additional drilling in the area, a total of approximately 3,366 billion cubic feet (BCF) would be recovered by existing operations, leaving approximately 7,134 BCF unrecovered (Table 2.3). Recovery volumes would vary depending upon the total number and types of wells (vertical or directional) drilled, and, based upon the alternatives analyzed in the EIS, recovery volumes are estimated to range from 3,366 to 8,191 BCF.

Up to twenty drilling rigs rated for drilling to depths of 12,000 ft or more may be employed simultaneously during project development to accommodate development of 250 wells per year. However, if a slower development pace occurs (e.g., 150 or 75 wells developed per year), the number of simultaneously operating rigs would likely be reduced. Drilling is scheduled to begin in 2005, subsequent to the release of the Record of Decision for this project. Operators propose to drill throughout the year utilizing the mitigative measures and environmental considerations outlined in EIS Appendix B. All drilling operations and other well site activities would be conducted in compliance with applicable BLM, Wyoming Oil and Gas Conservation Commission (WOGCC), WDEQ, and other federal, state, and county rules and regulations.

Including rig up and rig down activities, drilling each vertical well would take an average of approximately 22 days, with some additional time potentially being required for wells drilled deeper than 12,000 ft. Drilling would require approximately 22 individuals, including two 11-person rig operations crews necessary to conduct drilling 24-hr/day (see Table 2.2). Most project personnel would be hired locally, and construction workers, rig crews, and support personnel likely would live in Pinedale, Rock Springs, Boulder, Big Piney, Marbleton, La Barge, or Eden/Farson. Approximately 200 round trips to each well location would be required during vertical well drilling operations (see Table 2.1).

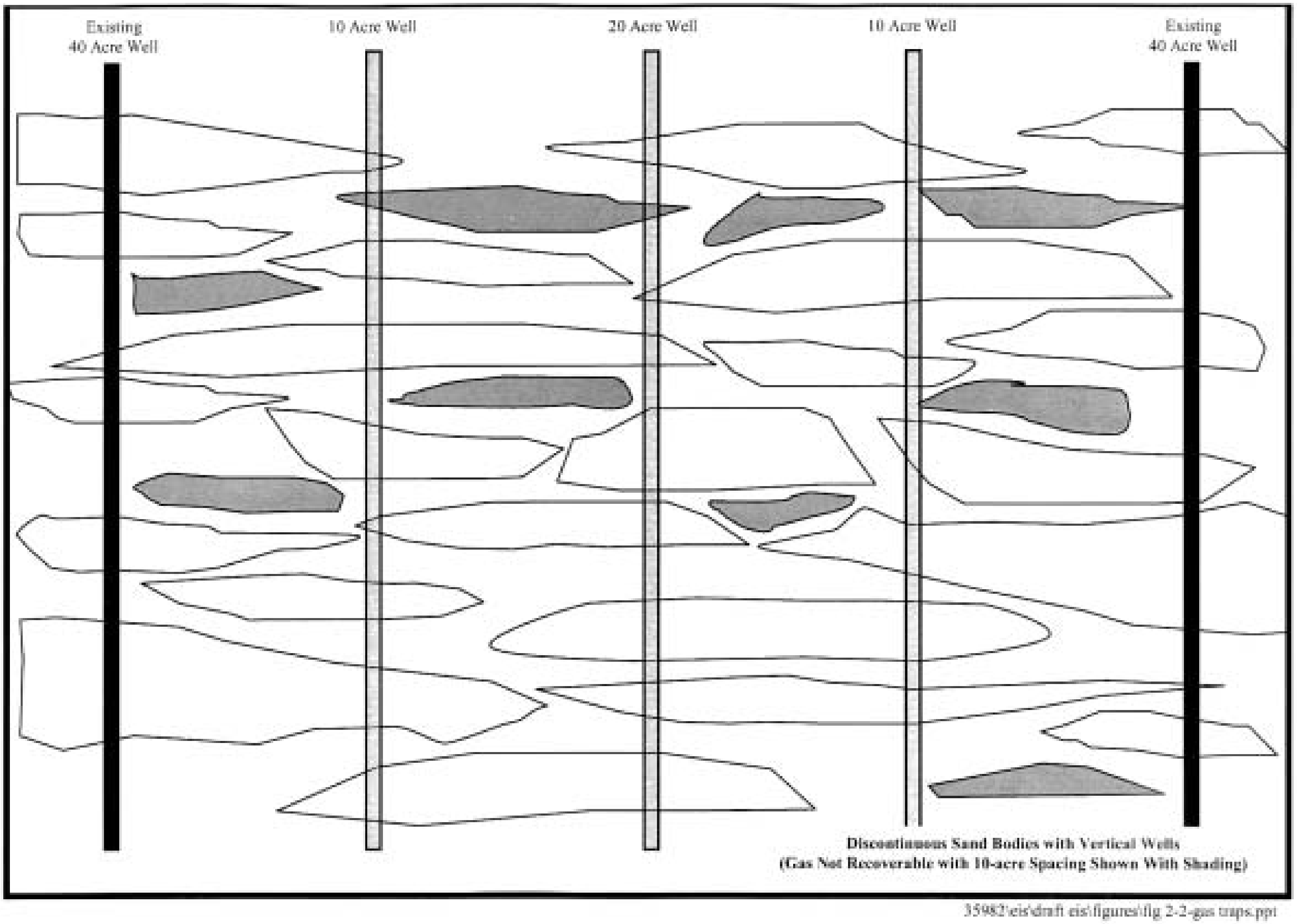
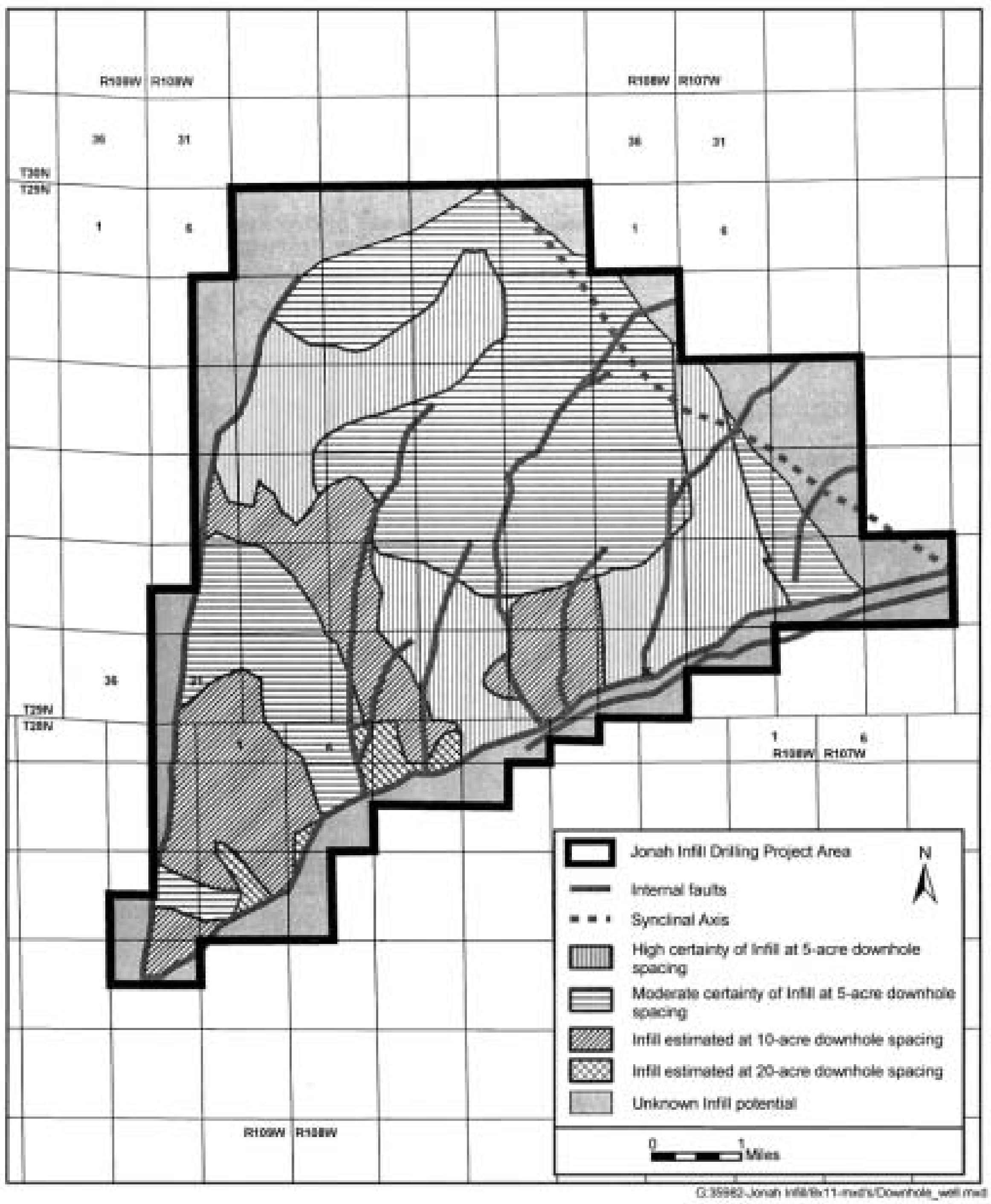


Figure 2.2 Representation of Gas Traps, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.



Map 2.1 Down-hole Well Spacing Potential, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

Table 2.3 Anticipated Gas Recovery Volumes, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Development Technique	Estimated Recovery Volumes (billion cubic feet [BCF])[2]	Estimated Unrecovered Volumes (BCF)[2]
No New Wells	3,366	7,134
3,100 Wells/16,200 acres disturbance[3]	7,947	2,533
3,100 Wells/3,100 new well pads	8,191	2,309
3,100 Wells/Existing 497 Well Pads[3]	6,124	4,376
1,250 wells/1,250 new well pads	6,657	3,843
2,200 wells/2,200 new well pads	7,554	2,946
3,100 wells/266 new well pads (16 total pads/section)[3]	6,302	4,198
3,100 wells/1,028 new well pads (32 total pads/section)[3]	7,186	3,314
3,100 wells/2,553 new well pads (64 total pads/section)[3]	7,876	2,624

[1] Data provided by EnCana.
[2] Assumes 10,500 billion cubic feet (BCF) of gas in place; 1 BCF corresponds to the annual use by approximately 13,700 residences (Energy Information Administration 2004). Typical gas field recoveries range from 75%-85% of gas in place.
[3] Assumes 10% of directional wells do not reach total depth and 1,000 ft of formation cannot be developed. Does not fully account for losses/unrecovered resources associated with undeveloped wells (assumed uneconomic).

Figure 2.3 presents a schematic representation of a typical vertical well pad layout during drilling.

Whereas vertical drilling is the Operator-preferred method for well development, directional drilling would be used to recover gas beneath sensitive areas (i.e., 0.25-mile greater sage-grouse lek buffers, 825-ft active raptor nest buffers, and the 600-ft Sand Draw buffer) (Map 2.2). To accommodate development of reserves beneath these areas, as many as 422 directionally drilled wells would likely be developed under the Proposed Action; since the aforementioned buffers would not be avoided under Alternative A, fewer directionally drilled wells would likely be developed. Additional directionally drilled wells would also likely be developed under all

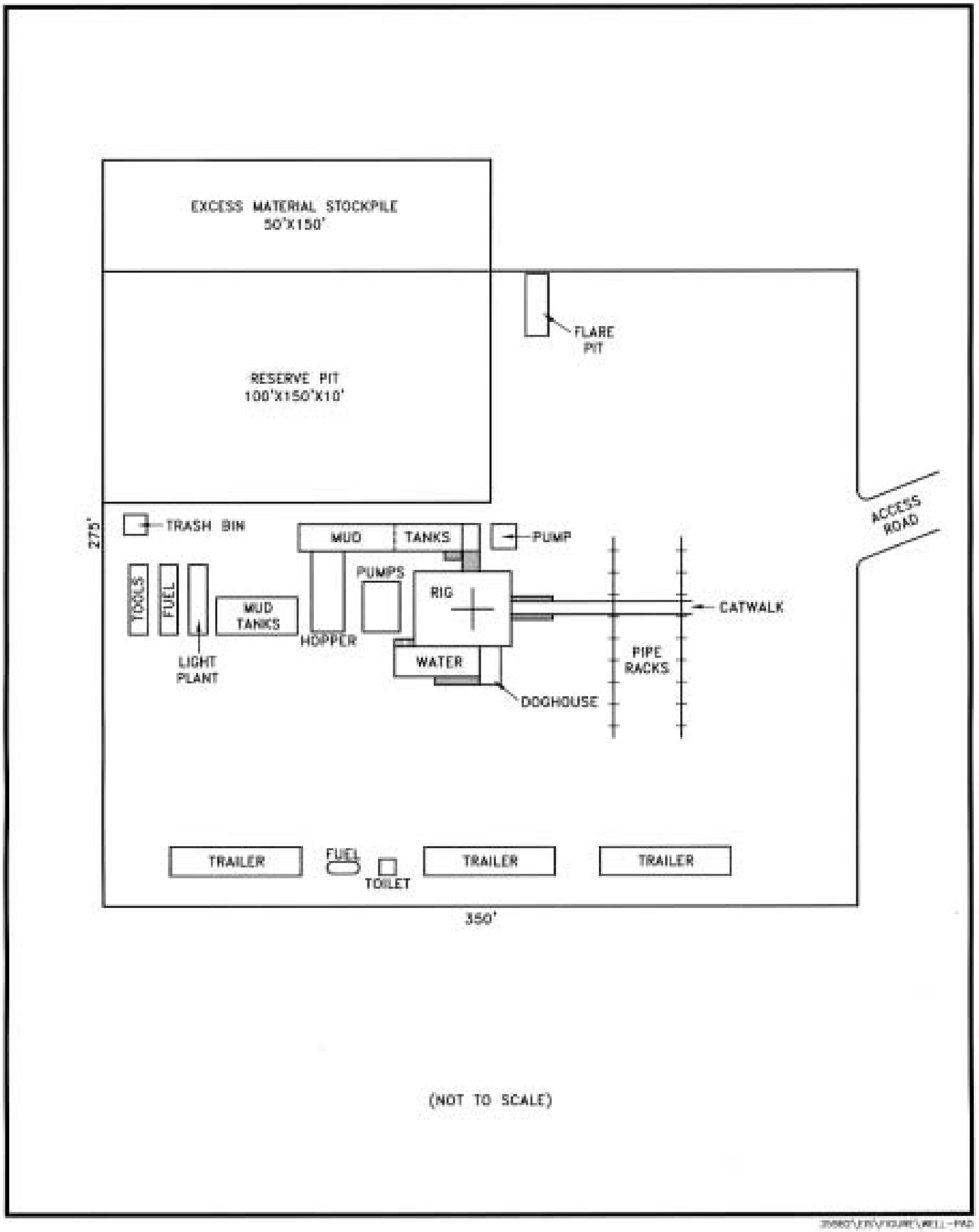
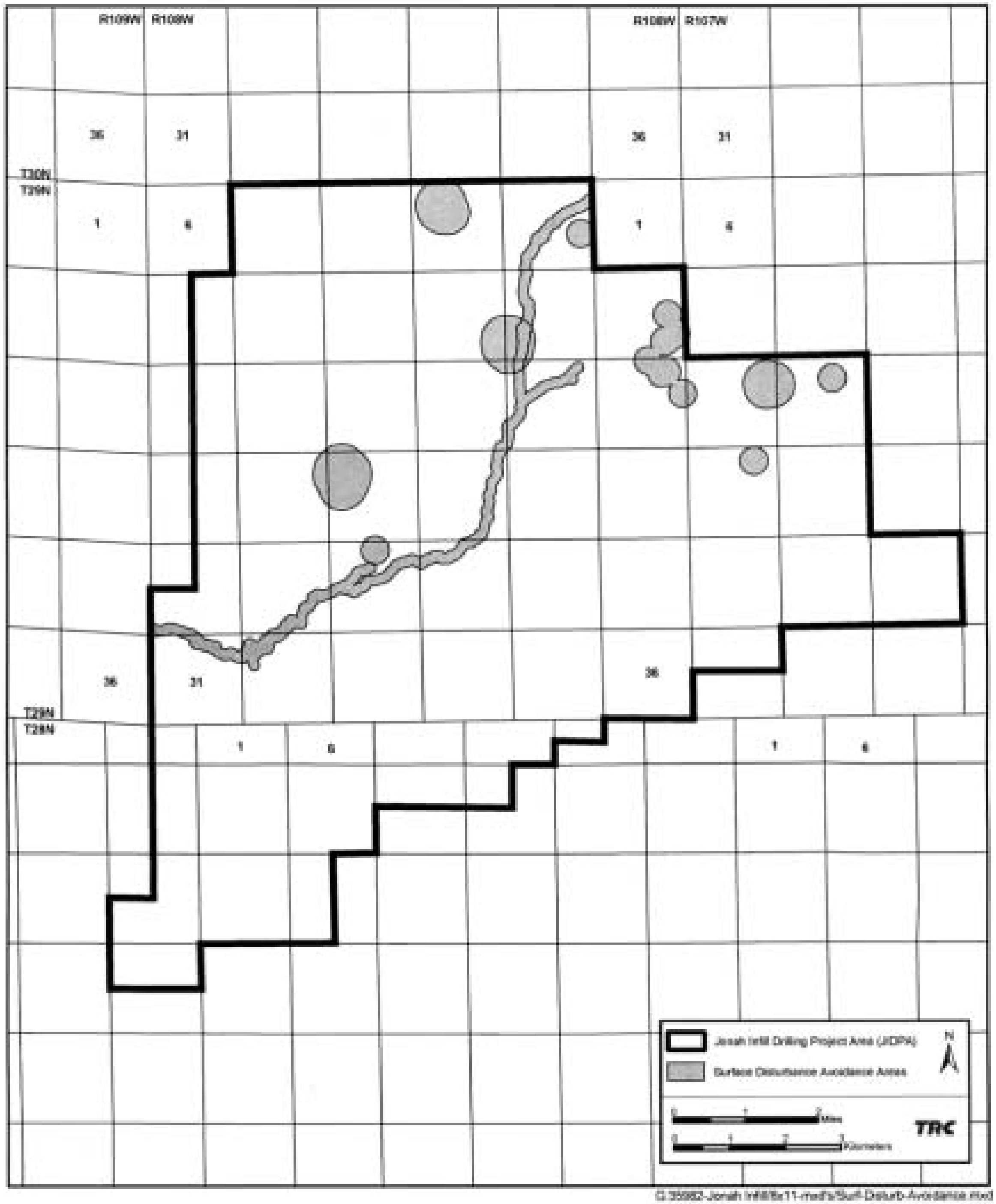


Figure 2.3 Schematic Representation of a Typical Vertical Well Pad Layout During Drilling, Jonah Infill Drilling Project, Sublette County, 2004.



Map 2.2 Surface Disturbance Avoidance Areas, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

alternatives to access reserves beneath areas with steep slopes and other topographic features. Additional directional wells would likely be developed under Alternatives B and E-G due to surface disturbance limitations. However, directional wells have a greater risk of total failure, require additional time and costs to develop, may be uneconomic in some cases, and may result in unrecovered reserves.

Directional drilling provides for the construction of a single well pad that may accommodate as many as 13 wells. Figure 2.4 provides a summary schematic of a multi-well pad developed at an existing vertical well pad site. Drilling directional wells would require an average of 26 days to drill, including rig-up and rig-down operations. With multiple well pads, the initial and LOP disturbance required for each pad is increased. Initial disturbance may be 10 acres per pad and LOP disturbance 3 acres per pad. However, these multiple well pads may be serviced by one access road and gathering system pipeline, as well as a single separation, dehydration, and storage facility. Where new directional wells are developed at an existing well site, separate separation, dehydration, and storage facilities may be used. Use of directional drilling techniques would be contingent upon economic and technical feasibility, potential resource recovery issues, and environmental considerations. An evaluation of directional drilling in the Jonah Field can be found in Encana Oil and Gas (USA) Inc. (EnCana) (2004).

Most wells would be completed in the Lance Formation (Lance Pool); however, secondary reserves may be encountered in other formations, and approximately 100 acres of new and LOP disturbance are anticipated for exploration activities. Drilling would occur commensurate with new discoveries coupled with anticipated developmental costs and gas prices.

Drilling operations primarily would utilize a water-based mud system with additives to minimize downhole problems; however, oil-based mud systems (closed/tank-controlled) may be employed at some wells (more likely with directionally drilled wells). Drilling would require approximately 11,000 barrels (bbl) of water per well (42 gal/bbl) (1.4 acre-ft). Total drilling water requirements for a 3,100 well project would be approximately 4,395 acre-ft, or 338 acre-ft per year over a 13-year well development period (250 wells per year case). The rate of water use

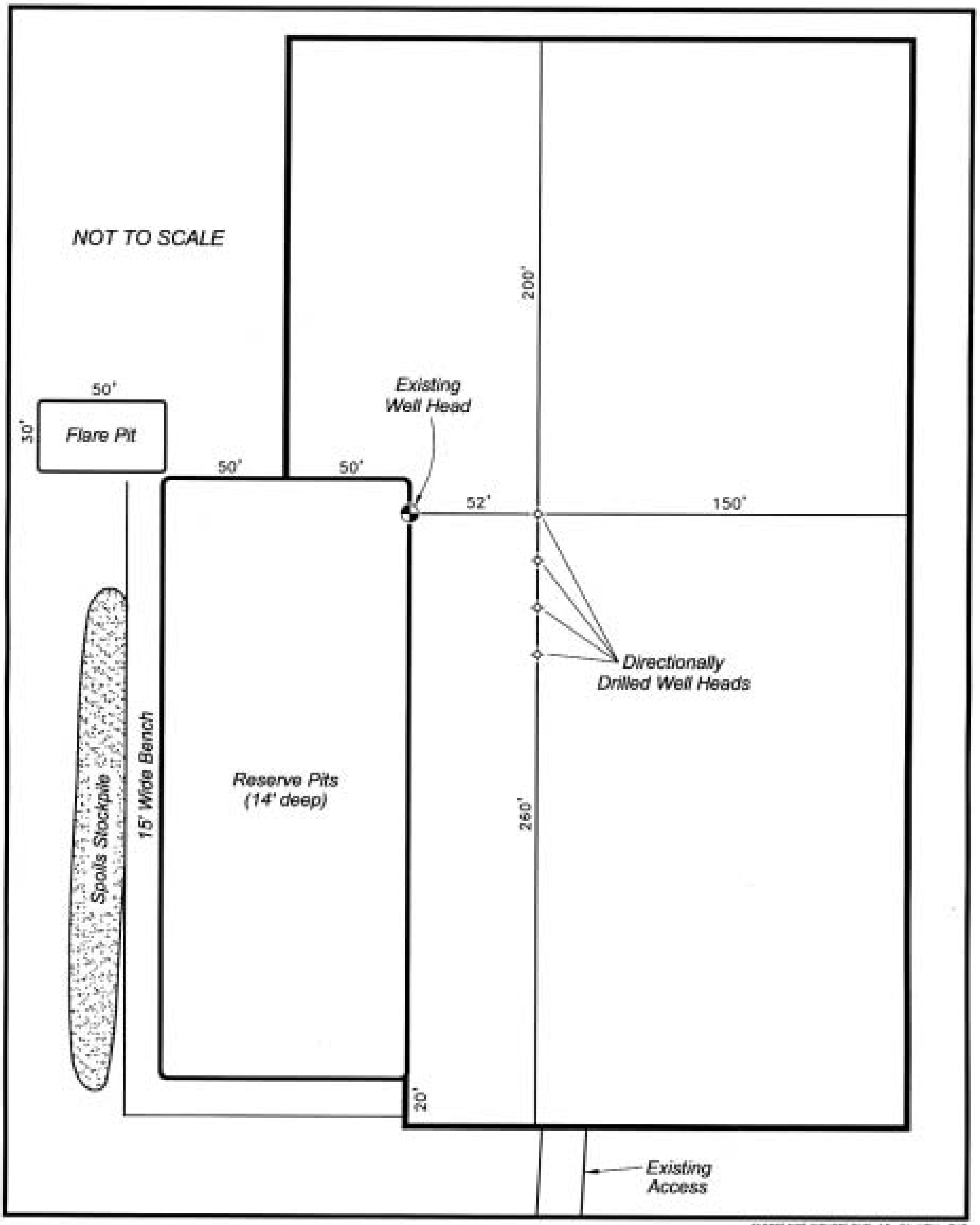


Figure 2.4 Example Directional Drill/Multi-well Pad Layout at an Existing Well Pad, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

may decrease if fewer natural gas wells are developed per year, and total water needs may be reduced if fewer natural gas wells are drilled. Additionally, directional drilling requirements may result in increased water use.

While produced water recycling would be maximally employed (see Section 2.8), additional water would be required and would be obtained from the existing 25 water wells developed in the JIDPA for current development operations and approximately 16 new water wells. Fewer additional water wells would be developed in the event that development occurs at a pace of less than 250 wells per year. Water wells would be developed on natural gas well pads and would require no new surface disturbance and <0.5 acre of LOP disturbance.

Water would be trucked or piped from water wells and/or treatment facilities to drilling sites depending on site-specific conditions, disturbance requirements, and time of year. Water pipelines would be temporary and would consist of either standard 3- to 6-inch diameter aluminum sections or polypipe. These water pipelines would be laid on the ground surface within road ROWs or directly overland and would be removed after completion/testing operations are done. The contracted water hauler would be responsible for obtaining any required permits from the Wyoming State Engineer's Office (WSEO). Water used to drill a well would be reused for drilling subsequent wells to the maximum extent practicable.

Cuttings and all drilling fluids would be contained in the reserve pit, and drilling fluids would be recovered and reused to drill the next well to the maximum extent possible. If oil-based fluids are used, they would be recovered in tanks. If any oil enters reserve pits, it would be removed pursuant to WOGCC rules and regulations and the pit would be flagged overhead or covered with netting to prevent waterfowl use in compliance with BLM Informational Bulletin Number WY-93-054.

Any shallow water zones encountered during drilling would be reported and adequately protected by installing surface casing and cementing back to the surface. After completion of drilling, the well would be logged and production casing run in accordance with the drilling program approved in the APD. Surface casing would be set to a depth adequate to isolate near-surface freshwater aquifers (approximately 2,500 ft). Production casing would be run and cement circulated to a minimum of 400 ft above the Lance Formation, effectively isolating all geologic formations and eliminating any fluid migration between hydrocarbon-bearing zones and freshwater aquifers (Figure 2.5).

2.7 COMPLETION OPERATIONS

Once the well has been drilled and cased, completion operations would begin to clean the well bore, to conduct pressure testing, and to perforate potentially productive zones. A bond log would be run (a bond log is the process by which the integrity of the cement bond between the casing and the borehole is verified), casing would be perforated in potentially productive zones downhole (e.g., Lance Pool sand lenses), and production tubing run. Multiple sand lenses would be fracture-stimulated. Fracture-stimulation (fracturing) is the process by which sand, nitrogen foam, and other materials are pumped downhole under pressure through the perforations in the casing and subsequently into the formation. As the formation is fractured, the spaces (fractures) are filled with sand to prop open the fractures and facilitate the flow of gas into the wellbore and through tubing to the surface.

On completion of fracturing, the well is flowed back to the surface in an attempt to recover as much of the fracture fluid as possible and to clean excess sand out of the perforations. Production tubing would be set, if warranted, prior to installing production equipment and placing the well "on line." All fracture fluid additives would meet BLM and/or U.S. Environmental Protection Agency (EPA) requirements for disposal of oil field wastes. All fluids utilized in the completion procedure would be contained on the well pad in pits or tanks and disposed of in compliance with state and federal rules and regulations.

In the past, gases and condensate produced in association with completion and testing have been diverted to an unlined flare pit and ignited (flared); however, for this project, it is anticipated that only about 50% of all future completion operations would utilize flaring. To minimize the need for flaring, a high-pressure flow-back unit designed to separate sand,

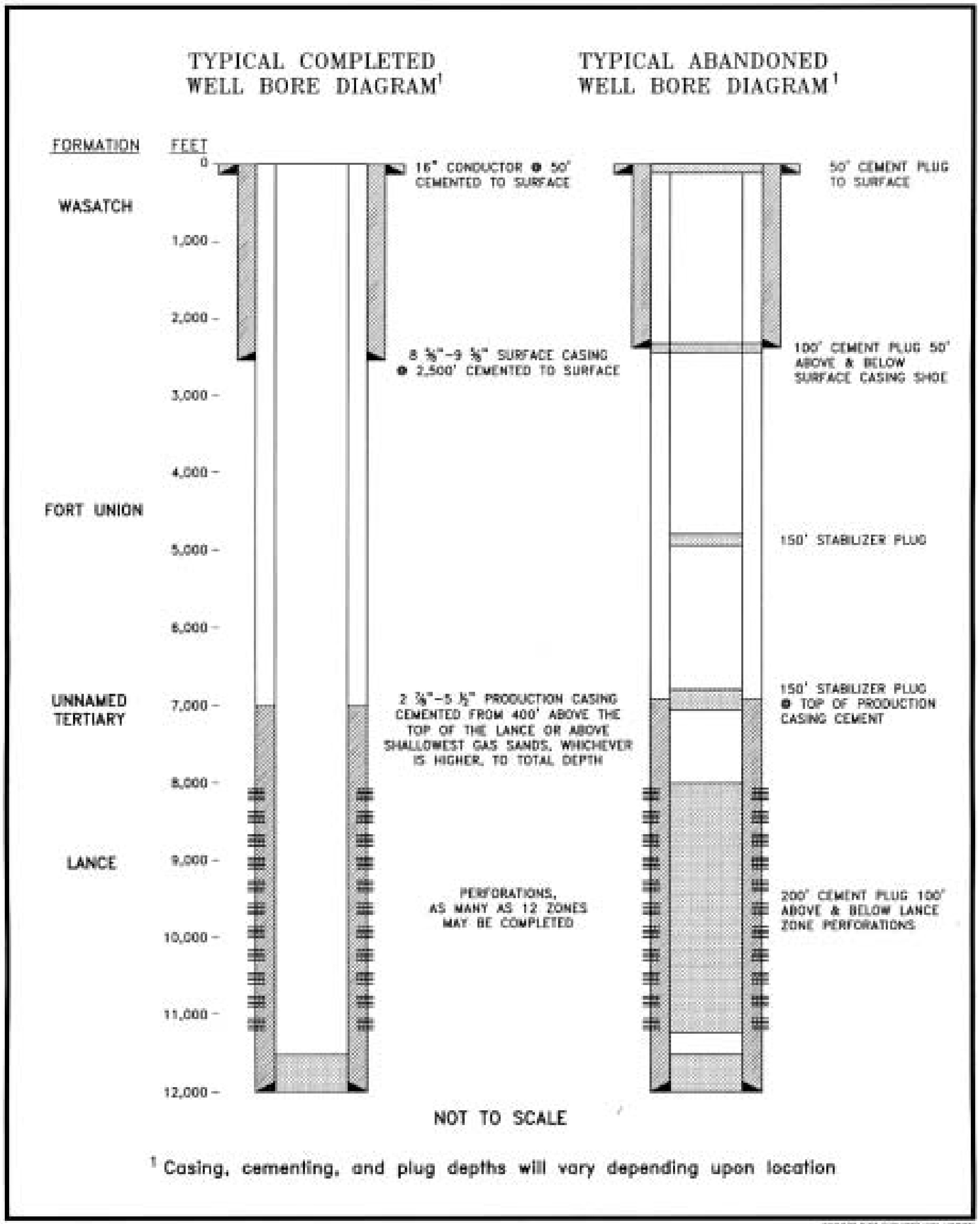


Figure 2.5 Typical Completed and Abandoned Well Bore Diagrams, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

condensate, natural gas, and water would be used. Sand would be piped to the reserve pit, water would be captured in a flow-back tank, and gas and condensate would be piped to the normal production unit. This process would result in the capture and sales of approximately 35 million cubic feet (mmcf) of gas and 250 bbl of condensate per well that would otherwise have been lost.

Approximately 33,300 bbl of water (4.3 acre-ft) would be needed for completion and testing of each well, and this water would come from the same locations as specified for drilling operations (see Section 2.6). The estimated total water requirement for drilling, completion, and testing operations at each well would be 44,300 bbls (5.7 acre-ft), and 10% or more of this water may be from recycling operations (see Section 2.8). Water requirements for 3,100 wells are estimated to be 17,700 acre-ft, approximately 1,362 acre-ft per year over a 13-year development period (250 well/year) case.

Completion and testing would require 11 workers for 35 days (Table 2.2), and workers would likely be from Rock Springs, Big Piney, or LaBarge.

The reserve pit would be closed pursuant to WOGCC rules and regulations and would generally be backfilled within two to three years following termination of drilling and completion operations, depending upon the rate of reserve pit fluid evaporation. If natural evaporation of the reserve pit is not feasible, alternative methods of drying, removal of fluids, or other treatment would be implemented. If fluids would be disposed of by any method other than evaporation or hauling to an approved disposal facility, approval by the BLM would be obtained. Off-lease disposal of fluids would be in strict accordance with all appropriate rules and regulations regarding the discharge, transport, and/or disposal of such fluids.

Reclamation of disturbed areas not needed for production would occur as specified in APDs and, upon completion, each vertical well pad would require approximately 0.9 acre of LOP disturbance. From 1.5 to 3.0 acres of LOP disturbance would be required for each multiple well pad.

2.8 PRODUCTION OPERATIONS

After well completion, production equipment would be set, gathering pipelines installed, and the well placed on line, with production continuing as long as the well is capable of commercial production and a demand for the gas exists (estimated at about 40 years per well). Production equipment typically would include a "Christmas tree" at the well head (a series of valves designed to control pressures and regulate flows from the well); separators to segregate natural gas, condensate, and water and to lower volatile organic compound (VOC) emissions; aboveground tanks for condensate and produced water storage; a methanol tank and pump; a glycol dehydrator and pump; and a meter run for measurement of gas volumes produced into the pipeline. More tanks or larger tanks would be required at multiple well pads. As gas production declines from wells so does condensate and water production and, over time, condensate and water tanks may be removed from well pads and/or smaller tanks may be installed to accommodate reduced storage requirements for condensate and produced water.

All aboveground production facilities would be painted a standard environmental color (e.g., Carlsbad Canyon) that blends with the surrounding landscape, except for structures that require safety coloration to comply with Occupational Safety and Health Administration regulations. A typical production facility layout is shown in Figure 2.6.

Natural gas production from wells in the JIDPA is expected to range from 0.5 to over 5.0 mmcf per day (mmcfpd), with average production field-wide expected to be 2-3 mmcfpd per well. As wells age, produced gas volumes would decline. Gas composition data is provided in Table 2.4. No hydrogen sulfide is known to occur in natural gas from the JIDPA, and none is expected to be encountered during project operations.

Condensate production from each well is expected to average from 5 to 45 bbl/day (i.e., approximately 9 to 10 bbl/mmcf of gas produced). Condensate constituents are shown in Table 2.5. Condensates would be stored in tanks at each well location, and all tank batteries would be bermed to contain 110% of the volume of the largest tank. Condensates would be

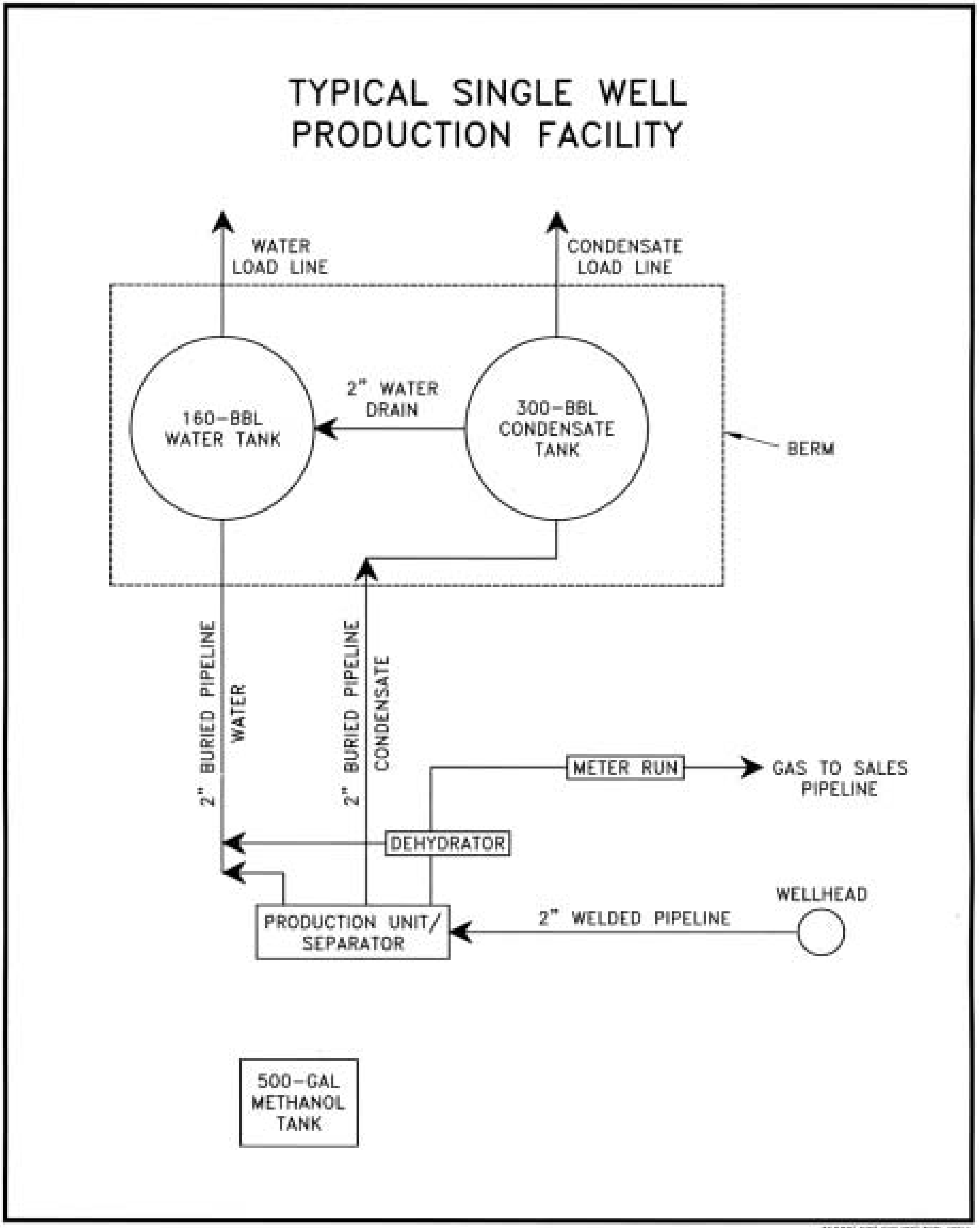


Figure 2.6 Typical Production Facility Layout, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

Table 2.4 Natural Gas Composition Analysis, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Component	Percentage by Weight
Carbon Dioxide	1.33
Hydrogen Sulfide	0.00
Nitrogen	2.21
Methane	77.90
Ethane	8.66
Propane	4.21
Isobutane	1.26
n-Butane	1.23
Isopentane	0.58
n-Pentane	0.41
Cyclopentane	0.00
n-Hexane	0.18
Cyclohexane	0.11
Other Hexanes	0.31
Heptanes	0.53
Methylcyclohexane	0.19
2,2,4 Trimethylpentane	0.0011
Benzene	0.054
Toluene	0.085
Ethylbenzene	0.0040
Xylenes	0.04
C8+ Heavies	0.70
Total	100.00

[1] Data provided by EnCana.

Table 2.5 Condensate Constituent Analysis, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Component	Percentage by Weight
Ethane	0.11
Propane	0.87
Isobutane	1.27
n-Butane	2.04
Neopentane	0.11
Isopentane	2.73
n-Pentane	2.82
2,2-Dimethylbutane	0.24
2,3-Dimethylbutane	0.76
2-Methylpentane	2.35
3-Methylpentane	4.76
n-Hexane	3.64
Heptanes	19.76
Octanes	29.35
Nonanes	18.61
Decanes plus	10.57
Other[2]	0.01
Total[3]	100.00

1 Data provided by EnCana.
2 Includes methane, nitrogen, and carbon monoxide.
3 Includes benzene (1.12%), toluene (4.84%), xylene (5.59%), and 2,2,4-trimethlypentane (0.34%), which are contained within some of the listed components.

removed from storage tanks on a periodic basis as needed and transported by truck for sale. Best available control technologies (BACTs) would be used to reduce VOC emissions from condensate storage tanks pursuant to WDEQ/AQD rules and regulations.

Water production volumes from natural gas wells initially start at about 5 bbl per mmcf of gas for about a 3-month period, then drop to about 2 bbl/mmcf thereafter. Produced water quality data are provided in Table 2.6. Water would be removed from the gas stream by the separators and dehydration, would be stored in a tank(s) at each location, and would be periodically removed and recycled or disposed of in accordance with BLM/WOGCC/WDEQ rules and regulations. Produced water would be trucked to approved disposal sites.

A produced water disposal system is currently in operation on state surface in the JIDPA (see EIS Map 1.2). The system consists of an oil separation facility and a series of lined surface pits. During the summer, the primary means of disposal is evaporation, which is enhanced by the use of a spray system to atomize the water. During the winter, this water is frozen into large mounds of ice. During the freezing process the water is ionically separated into fresh water, and a brine solution that is pumped off for storage and ultimate evaporation at the facility. The fresh water is stored as ice during the winter, and when it thaws in the spring, it is put to beneficial use (e.g., road watering).

Alternative water handling uses are currently being developed. Because produced water quality has steadily improved as a result of eliminating potassium chloride as a base fluid for fracturing, considerable volumes of water can now be recycled and reused. During the drilling phase of a well, produced water is used by some Operators to drill from the surface casing (below fresh water zones) to the top of the Lance Formation. On average 4,700 bbls of produced water are recycled and used during the drilling of a vertical well; however this amount may range from 2,000 to 12,000 bbls depending on well depth, time of drilling, and water loss problems. The quantity of water needed is increased with directional drilling due to pit sizes, total drill bore lengths, and other requirements; more mud is necessary for directional drilling.

Table 2.6 Average Water Quality from Natural Gas Wells, Water Wells, and the Existing Evaporation Pond and Relevant Class III Ground Water Quality Standards, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Water Quality Parameter	WDEQ Class III Underground water Quality Standard[2] (mg/l)	Produced Water[3] (mg/l)	Evaporation Pond[4] (mg/l)	Water Wells[4] (mg/l)
pH[5] (standard pH units)	6.5-8.5	7.49	7.80	9.69
Total Dissolved Solids (TDS)	5,000	4,527	4,752	670
Chloride	2,000	1,853	2,153	107
Sulfate	3,000	38	51	126
Barium	--[6]	<0.1	6.0	--
Boron	5	--	2.7	--
Aluminum[5]	5	4.5	--	--
Cadmium[5]	0.05	<0.001	--	--
Chromium[5]	0.05	<0.004	--	--
Copper[5]	0.5	<0.02	--	--
Iron	--[6]	<17.78	<2.09	0.17
Lead[5]	0.1	<0.34	--	--
Magnesium	--[6]	3.12	6.02	0
Mercury[5]	0.00005	<0.003	--	--
Arsenic[5]	0.2	<0.005	--	--
Selenium[5]	0.05	<0.003	--	--
Zinc[5]	25	1.8	--	--
Calcium	--[6]	292	651	0
Bicarbonate	--[6]	856	747	81
Carbonate	--[6]	355	--	110
Sodium	--[6]	1,042	1,051	245
Potassium	--[6]	--	83	--

1 Data provided by EnCana, McMurry Oil Company, and Schlumberger.
2 From WDEQ (1990).
3 Average produced water concentrations from 30 natural gas wells.
4 Evaporation pond data are from a single sample; water well data are an average from six water wells.
5 Produced water data are averaged from four natural gas wells.
6 -- = no WDEQ standards for Class III ground water.

Produced water is also being used to drill out frac plugs at the end of the completion phase, using from 2,000 to 4,000 bbls per well, depending upon the conditions of the well during the operation.

Produced water is also being used by some Operators as a component of a gel system for fracture stimulation of new wells. Starting in the fall of 2003, use of produced water for fracturing has resulted in the utilization of up to nearly 100% of produced water volumes for some Operators. Currently almost all of EnCana's produced water is being reused for fracture stimulation and/or drilling operations.

Slick-water fractures are also being employed for some completions. This is fresh water, with a low concentration of friction reducer, and sand without gels or cross-linker systems. The effectiveness of this technique is being evaluated from completion operations at the five wells where it has been employed.

One water disposal well is present in the JIDPA (6,500 ft deep/Fort Union Formation) (see EIS Map 1.2) and at least two additional disposal wells are proposed to accommodate produced water and brine disposal needs. All water disposal and underground injection wells would be developed in compliance with *Onshore Oil and Gas Order Nos. 1, 2, and 7*, as well as WOGCC Underground Injection Control rules and regulations (WOGCC Rule 405) governing the subsurface disposal of water.

Supervisory Control and Data Acquisition (SCADA) facilities are being established at many wells in the JIDPA. This system is designed to increase production efficiency by providing real-time operating information to field staff, including well flow rates and pressures, processing equipment operating conditions, tank levels, and emissions control equipment status. Implementation of the SCADA system reduces the number of well pad visits (and associated traffic) by 30 to 40% from the number of pad visits necessary without SCADA. SCADA real-time monitoring also reduces the potential for spills (tank-level monitoring) and the reliability of emissions control equipment.

Routine on-site maintenance operations at each producing well (with SCADA) generally would include worker visits every 3 days to monitor the overall operation of the well and make adjustments as required to ensure efficient operation. An average of 20 wells could be visited each day during production. Well workovers would occur every 10 to 20 years; however, workovers would not be undertaken on a set schedule but rather on an as-needed basis to increase or maintain production from downhole producing zones or to re-complete in new zones.

A well would require a workover for any of several reasons:

- changing or replacing old tubing, rods, or pumps;
- refracturing producing formation(s) using advanced techniques designed to stimulate additional production;
- cleaning out the well bore and perforations to stimulate/facilitate production; and
- "re-completing" in other potentially productive zones that were not originally completed at the time the well was drilled.

2.9 PIPELINES

Industry-standard pipeline equipment, materials, techniques, and procedures in conformance with all applicable regulatory requirements would be employed during construction, testing, operation, and maintenance of pipelines. Depending on the location of acceptable tie-ins, gathering pipeline ROWs would be located within/adjacent to road ROWs to the greatest extent practicable to minimize surface disturbance and to maximize construction and gas transport efficiency. A typical access road with adjacent gathering pipeline is shown in Figure 2.1. Pipeline trenches would generally be 2 to 3 ft wide and located 8 to 10 ft outside of the road outslopes. All trenches would be backfilled and compacted as soon as possible. To facilitate compaction, no vegetation or snow would be present in the trench during backfilling. Pipeline ROW reclamation would be initiated as soon as practical following disturbance, in accordance with Appendix B (Reclamation Plan).

All newly constructed pipelines would be tested with natural gas or water to ensure their integrity. Testing would consist of filling pipeline segments and pressurizing to levels exceeding operating pressures. If leaks or ruptures occur, they would be repaired and testing would be repeated until successful. Natural gas used for testing either would be returned to the gathering system for sales or vented to the surface in accordance with Notice to Lessees (NTL)-4A and/or WOGCC Rule 340. If fresh water would be used for pipeline testing, the water would be discharged (upon completion of the testing) to existing drainages at rates less than the existing capacity of the affected drainages in accordance with requirements of a temporary permit issued by WDEQ/Water Quality Division (WQD).

2.9.1 Gathering System Pipelines

Natural gas would be transported from well pads via buried pipelines generally from 3 to 12 inches in diameter to larger existing lines within the field. Pipelines generally would follow roads to minimize surface disturbance; however, where limited by topographic or other constraints, some lines may be built away from roads. The approximate width of gathering system pipeline ROWs would be 35 ft outside of and adjacent to road ROWs (50-ft total pipeline ROW width), and an average 0.15 mile of buried pipeline would be required per well pad. Where multiple wells are developed at a single well pad, only one gathering system pipeline would be necessary.

2.9.2 From-field Transport Pipelines

Two existing pipelines within a single corridor are currently being used to transport natural gas from the JIDPA. No additional pipelines from the field are currently proposed; however, in the event new transport pipelines are proposed, further pipeline-specific *National Environmental Policy Act of 1969* (NEPA) analyses would be implemented.

2.10 COMPRESSOR STATIONS

While not specifically proposed for this project, with the anticipated increase in gas production from the JIDPA and other nearby natural gas fields (e.g., Pinedale Anticline), additional pipeline compression needs have been identified. No new compressor stations would be built, but existing stations in the area would be expanded. Table 2.7 provides a listing of the primary stations utilized for JIDPA gas transport, as well as their existing permitted compression horsepower and anticipated expansion requirements. A total of approximately 33,844 horsepower of new compression is anticipated in part as a result of this project.

2.11 ABANDONMENT AND RECLAMATION

At the end of a well's useful life, Operators would obtain all necessary authorizations from the BLM or WOGCC to abandon the well. All aboveground facilities would be removed, and all unsalvageable materials would be disposed of at authorized sites. Wells would be permanently plugged according to BLM and/or WOGCC requirements, including 43 C.F.R. 3162.3-4 and *Onshore Oil and Gas Order No. 1*. Pipelines would be purged of combustible materials and abandoned in place or removed, based on landowner specifications. Abandoned wellpads, roads, and other disturbed areas would be restored to near pre-disturbance condition and revegetated according to the specifications of the BLM or private landowner, the Reclamation Plan (Appendix B), and/or as specified in the APD or ROW grant, unless they are determined to be left in place by the BLM or private landowner. All disturbed surfaces would be recontoured to their approximate original contours, with reclamation of the wellpad and access road performed as soon as practicable after final abandonment.

Table 2.7 Existing and Anticipated Compression Requirements (Horsepower), Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

	Compressor Stations					
Compression Status	Bird Canyon[1]	Luman[2]	Yellow Point[3]	Jonah Field[4]	Falcon[5]	Total
Existing Permitted	15,746	18,340	1,121	4,899	11,736	51,842
Anticipated Future	11,004	11,604	0	3,900	7,336	33,844
Total	26,750	29,944	1,121	8,799	19,072	85,686

1 Duke facility at NW¼, Section 34, T27N, R111W, southwest of the JIDPA.
2 Duke facility at NE¼, Section 24, T28N, R109W, just south of the JIDPA.
3 Duke facility at NE¼, Section 13, T28N, R109W, in the JIDPA.
4 Mountain Gas facility at Section 34, T29N, R108W, in the JIDPA.
5 Duke facility at SW¼, Section 36, T29N, R108W, just north of the JIDPA.

2.12 HAZARDOUS MATERIALS

All procedures identified in Appendix C of this document (Hazardous Material Management Summary) would be applied for this Project.

During the course of routine oil and gas production operations, minor leaks, spills, and other accidental releases of crude oil and condensate may occur, thereby creating hydrocarbon-impacted soils. While the surface use lease may allow for the temporary storage and treatment of oil-contaminated soils on well pads, some Operators discourage this practice.

As a Best Management Practice, one Operator plans to transport, accumulate, and treat these contaminated soils at a new bioremediation facility dedicated solely to soils remediation (EnCana 2003). This proposed ancillary facility would be located on state surface in the SW¼ NE¼, Section 36, T29N, R108W. The dimensions of the facility would be 200 x 200 ft. Containment berm walls 2 ft high x 4 ft wide would be located on the east, south, and west perimeters of the pad to contain storm water runoff. Erosion controls would be installed on the soil berms and pad shoulders to maintain their integrity, and walls and shoulder would be revegetated during operations. All weather year-round access to the facility would be maintained, and the facility would be gated and locked.

Point sources for hydrocarbon-impacted soils are wellhead and production battery spills and releases, as well as gas and flow line leaks. The typical range of hydrocarbon contamination, expressed as total recoverable petroleum hydrocarbons (TRPH), ranges from <500 ppm to >20,000 ppm depending on such factors as spill volume, exposure time, and weather.

Hydrocarbon-impacted soils would be treated at the facility by enhancing hydrocarbon degradation with indigenous bacteria. Impacted soils would be placed in windrows approximately 10 ft wide x 120 ft long and 24 inches deep. On a scheduled basis, the soil mass in each windrow would be turned to continually expose soil mass layers to oxygen, moisture, and sunlight. No tillage of the soils would occur during periods of high winds or when surface conditions would create fugitive dust emissions.

Impacted soils received at the facility that reflect hydrocarbon concentrations in excess of 20,000 ppm TRPH would be blended with soils exhibiting lower hydrocarbon concentrations to avoid pockets of high hydrocarbon concentrations in soil masses.

When an individual windrow is filled to designated dimensions and volumes, hydrocarbon concentrations would be periodically measured using an organic vapor meter (OVM). When OVM readings indicate that hydrocarbon concentrations have dropped to <1,000 ppm, a composite sample of the soil mass would be collected for TRPH analysis. When TRPH concentrations have dropped below WOGCC TRPH-concentration limits, the soil mass would be removed from the facility for recycling under a variety of uses approved and stipulated by the WOGCC. The primary use of remediated soils from this facility would be construction related (e.g., road grades).

Notice of any spill or leakage, as defined in BLM NTL 3A, would be immediately reported by the Operator to the BLM and other federal and state officials (e.g., WDEQ) as required by law. Verbal notification would be given as soon as possible but no later than 24 hrs after the discovery of the incident. Verbal notification would be confirmed in writing within 15 days or other such time required by the appropriate regulatory agency. Any release of hazardous substances (leaks, spills, etc.) in excess of the reportable quantity, as established by 40 C.F.R. 117, would be reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as amended (42 *United States Code* [U.S.C.] 9601 et seq.). If the release of a hazardous substance in a reportable quantity does occur, a copy of the report would be furnished to the BLM and all other appropriate federal and state agencies.

Additionally, all work sites and work activities in the JIDPA would be in compliance with OSHA rules and regulations, including OSHA regulation 49 C.F.R. 1910.1028 (benzene).

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APPENDIX A:

TRANSPORTATION PLAN,
JONAH INFILL DRILLING PROJECT

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TRANSPORTATION PLAN,
JONAH INFILL DRILLING PROJECT

Prepared for

Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

Bureau of Land Management
Pinedale Field Office
Pinedale, Wyoming

and

Bureau of Land Management
Rock Springs Field Office
Rock Springs, Wyoming

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 35982

February 2005

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ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
APD	Application for Permit to Drill
BLM	Bureau of Land Management
EIS	Environmental impact statement
HS-20	Refers to the AASHTO truck type and axle load rating
I-80	Interstate 80
JIDPA	Jonah Infill Drilling Project Area
LOP	Life-of-Project
Operators	Oil and gas and pipeline companies
PFO	Pinedale Field Office
ROW	Right-of-way
RSFO	Rock Springs Field Office
TP	Transportation Plan
TPA	Transportation planning area
TRC Mariah	TRC Mariah Associates Inc.
WDOT	Wyoming Department of Transportation

A-1.0 INTRODUCTION

A-1.1 OBJECTIVES

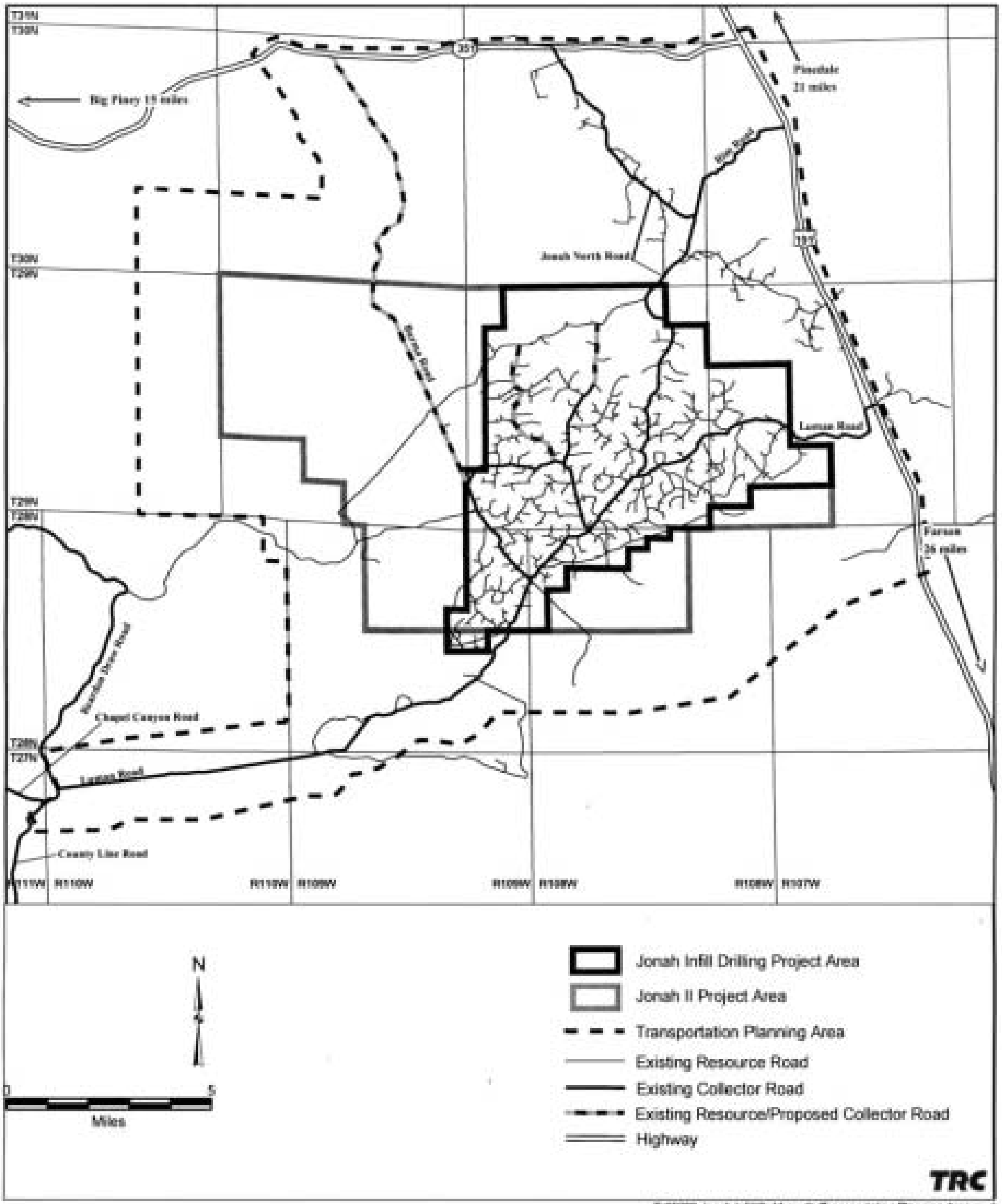
This Transportation Plan (TP) was prepared to supplement a proposal by oil and gas companies (Operators) to drill new wells in the Jonah Infill Drilling Project Area (JIDPA), as described in the Jonah Infill Drilling Project Area environmental impact statement (EIS). This TP provides an assessment of future road development and use in and around the JIDPA and of potential impacts to the existing transportation system and provides a basis for future oil- and gas-related exploration and production transportation planning within the area.

The transportation planning area (TPA) includes the JIDPA plus adjacent areas that include roads that may be used to access the JIDPA (Map A-1.1). The TPA includes U.S. Highway 191 (1.5 to 10.0 miles east of the JIDPA) and State Highway 351 (6 miles north of the area). More detailed maps of the TPA are available for review at the Bureau of Land Management (BLM) Pinedale Field Office (PFO) and Rock Springs Field Office (RSFO).

This TP deals primarily with corridors for proposed local and collector roads on and adjacent to the JIDPA. The EIS discusses the projected well development within the area and associated impacts due to the development. Localized planning for each new well location would be necessary, and this document and applicable transportation codes and standards would be used in localized planning efforts. Operational updates would be made during project development to detail specific localized transportation networks, if deemed necessary by the BLM. All new or upgraded roads in the TPA would incorporate the general provisions of this planning document.

The objectives and content of this TP are listed and discussed below.

- The annual operational update process is described, including scheduling and responsibilities.



Map A-1.1 Transportation Planning Area and Existing Road Network.

- Existing roads in the JIDPA are described, and primary routes (i.e., project-required collector and local roads) are identified on maps. High volume roads (i.e., local or collector roads) and resource, two-track, and other unimproved roads are also discussed.
- Existing roads and road corridors that may be used as collector or local roads for the proposed project are identified.
- Existing natural gas pipelines in the JIDPA are shown, and pipeline development actions are presented.
- Natural transportation obstacles (e.g., steep terrain, drainages) and environmentally sensitive areas (e.g., sage grouse leks, raptor nests) are identified. These areas would be avoided, where practical, when determining the location of future high traffic volume transportation routes.
- Soils in the JIDPA are identified, and their limitations for project operations are presented. A brief description of field evaluation and observation methods for determining if a soil may have erosion, stability, or other problems is also presented.
- Road types are discussed by functional classification. Standard road surface, construction-related disturbance, and right-of-way (ROW) widths are provided in the EIS.
- Maintenance and other agreements are discussed.

This document was prepared for the BLM by TRC Mariah Associates Inc. (TRC Mariah).

A-1.2 SCOPE

The scope of this TP includes a description of the existing road network, the general locations of proposed high-traffic-volume roads and corridors, and definitions of the road types. Relevant requirements for road construction or upgrading are identified. A working plan is outlined to help determine the procedures for planning a road to serve a proposed well, or group of wells, and the development of agreements for use and maintenance are outlined.

This plan also applies to the transportation of gas, condensate, or water via pipelines within the area. Pipelines generally would be located adjacent to roads to reduce the total amount of new surface disturbance. However, this design may complicate route selection, and in some instances, lead to increased environmental impacts. If this occurs, pipelines would be located along alternative routes.

Existing and improved access roads to the JIDPA are under the jurisdiction of the BLM, who approves their design and requires their maintenance. Most roads within the JIDPA also are under the jurisdiction of the BLM, and maintenance of these roads is conducted by Operators. This document describes the responsibility for road maintenance, and the type of maintenance is discussed generically (see Section A-7.0). Operators would provide the BLM with copies of road maintenance agreements that include the name of a designated contact person. Non-oil-and-gas roads would be maintained by the BLM or other ROW holder.

A-1.3 LIMITATIONS

- The condition (e.g., road design, upgrading requirements) and maintenance status (e.g., plowed) of existing roads and casual routes in the transportation network are identified on detailed maps available at area BLM offices. Many existing roads may not be passable during inclement weather or during winter months. All roads developed for this project would need upgrading, maintenance, and winter snow removal. Specific road upgrading and maintenance responsibilities would be identified annually, under the direction of the BLM.
- Due to the sensitivity of paleontologic and historic/cultural resources, the known locations of these resources on and adjacent to the JIDPA are not provided. Further detail on paleontological and historic/cultural resources would be collected prior to road development as a component of the Application for Permit to Drill (APD) and/or ROW application process.

- The transportation network described in this document is focused on local and collector roads and potential road corridors; however, existing low-traffic-volume resource roads and unimproved roads also are identified on the detailed maps available for review at the BLM PFO and RSFO.

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A-2.0 PUBLIC INVOLVEMENT/TRANSPORTATION PLAN SCOPING

Transportation issues and concerns were identified during the preparation of this and other regional oil and gas development EISs. The BLM PFO requested public and agency input on the Jonah Infill Drilling Project in April and December of 2003 through scoping letters, press releases, and phone calls to potentially affected area users and management agencies. Those contacted include Operators; local and regional media sources; federal, state, and local government representatives; state and county transportation departments; the Wyoming Game and Fish Department and other state offices; recreation and conservation groups; livestock permitees; and other potentially affected entities. A complete list of contacts can be obtained from the BLM PFO.

All comments received during the scoping process were considered in developing this TP. Comments included the following.

- Roads should not be overdesigned.
- Pipelines should parallel roads.
- Pipelines and power lines should be buried.
- Unburied pipelines can spook horses and make off-road travel more difficult.
- Undesirable conditions along two-track roads (e.g., poor drainage crossings) should be repaired, and these roads should be eliminated if another road accesses the same area.
- Two-track roads that are not used and which can be reclaimed should be identified.
- Two-track roads should not be eliminated.
- Access to two-track roads from high-traffic-volume crowned-and-ditched roads should be maintained.
- High-traffic-volume crowned-and-ditched roads should be constructed such that vehicles with horse trailers can pull off the road at regular intervals and avoid parking in borrow ditches.
- Livestock and wildlife watering areas should be avoided.
- Cattle guards should be cleaned out annually prior to May 1.

- Sand Draw and a 300-ft buffer should be avoided.
- Greater sage-grouse leks and associated buffers should be avoided.
- Noise impacts to greater sage-grouse should be considered.
- Greater sage-grouse and mountain plover surveys should be conducted to better define desirable road corridors.
- Development impacts to greater sage-grouse should be thoroughly evaluated and the following commitments made: 1) to adopt a policy of no surface disturbance within 3 miles of occupied leks and 2) to require road closures (permanent or seasonal) where oil and gas production is permitted.
- All off-road motorized travel in areas with threatened, endangered, proposed, candidate, and BLM Wyoming-sensitive species should be prohibited.
- A 1.0-mile disturbance-free buffer should be applied around bald eagle nests and winter roosts, or, if not practical, activity should be conducted outside of February 15-August 15 to protect nesting birds and November 1-April 15 to protect roosting birds.
- Mule deer winter range west of the JIDPA and east of the Green River may be impacted if access to the JIDPA is through Reardon or Chapel Canyons.
- The use of north/south-oriented roads should be maximized to accommodate pronghorn antelope movements.
- The impacts of the project on wildlife deaths due to increased traffic and animal/vehicle collisions should be addressed.
- Negative impacts of the road network on wildlife habitat, increased poaching, diminished enjoyment for hunters, visual impacts, and undue stress on wildlife during critical times of the year should be identified.
- To protect migratory animals: 1) no surface occupancy should be allowed in severe winter relief ranges for mule deer and pronghorn; and 2) a minimum buffer zone of 200 meters should be used for wells and roads until ongoing studies are completed and recommendations based on study results can be made.
- Overwinter fawn survival may decrease in response to human activity or other disturbances causing increased energy expenditure.

- Research has consistently documented avoidance by elk of roads open to vehicular traffic during the spring, summer, and fall months. The effects of open roads on mule deer and pronghorn are less understood.
- Animal-vehicle collisions can be a major source of ungulate mortality.
- Under the PFO and RSFO Resource Management Plans (RMPs) wells may be drilled during the summer months in crucial winter ranges and then maintained through the winter. Traffic associated with maintenance and general road traffic may continue to disturb big game in these areas, especially in the spring, when big game energy reserves are typically low.
- Limits on the density of wells and roads within important ungulate habitats as determined through monitoring and research efforts should be set.
- The TPA boundary should be extended westward to the Green River and southward to the Sweetwater County line.
- The use of looped roads should be minimized to avoid increased traffic.
- Turnout lanes and adequate site distances should be considered for existing and future high traffic volume road junctions with existing highways.
- All roads developed for this project should be reclaimed when they are no longer required.
- Sublette County has no interest in acquiring any of the roads developed for this project.
- The ultimate road situation (i.e., after the project is completed) should be similar to predevelopment (pre-1990).
- The majority of large trucks currently access the JIDPA using the Luman Road, and the Luman Road should remain as the principal access road for large vehicles.
- The Burma Road currently is seldom used by large vehicles and should remain as such.
- Improvements to the Burma Road should include widening, installation of a new cattle guard and culvert, and appropriate surfacing.
- Close the Burma Road or leave it unimproved if additional access to the JIDPA is provided from the northeast.

- The southwest access to the JIDPA is used primarily by light-duty trucks.
- A road and pipeline corridor southwest of the JIDPA would be required for the life-of-Project (LOP), and an additional road and pipeline corridor may be required north of the JIDPA.
- No new road construction should be authorized; wells could be built along existing improved roads.
- Limit habitat fragmentation, protect current roadless areas, provide for aggressively closing of unnecessary or ecologically destructive roads, and provide for maintaining needed roads to reduce negative impacts.
- The TP should require adequate design considerations to minimize impacts and provide orderly and safe traffic movement. The plan should include dust mitigation measures and siltation barriers, and the county should use tax revenues obtained from gas production to pave primary field access roads, similar to the policy of paving roads for energy development in Campbell County.
- Ensure that no cross-country vehicle travel is allowed in known habitat or locations of BLM Wyoming-sensitive plant species within the JIDPA.
- New technologies designed to reduce project impacts should be tested during development and implemented as appropriate.

A-3.0 ROAD ROUTE DESCRIPTIONS

There are two paved all-weather roads currently providing access to the TPA--U.S., Highway 191 and Wyoming State Highway 351. The remainder of the roads are not paved. Most unpaved project-required roads are now appropriately surfaced (e.g., gravel, aggregate) to be passable when wet and during winter, and improvements and maintenance including snow removal are regularly performed. In addition, some realignment of these routes may occur to minimize impacts to sensitive resources, to ensure safety, and to maximize traffic flow efficiency. Map A-1.1 and the detailed maps available for review at BLM offices show the location of all existing roads including collector and local road routes with the highest traffic volumes on the TPA.

The following sections briefly describe the location and status of the road routes on the TPA used to access the JIDPA and in-field development sites. Any new roads and necessary improvements and realignments to existing routes would be developed in accordance with BLM standards, and all routes would be selected to ensure safety, to maximize transportation efficiency, to avoid sensitive environmental resources, and to minimize road densities.

A-3.1 U.S. HIGHWAY 191

U.S. Highway 191 is the primary transportation corridor currently linking the JIDPA (at the Luman Road and Rim Road) to regional communities (e.g., Pinedale, Rock Springs). U.S. Highway 191 has an average of 1,460 vehicles per day from the Sweetwater County line to State Highway 351, and approximately 1,300 vehicles travel north from State Highway 351 to Boulder, Wyoming, each day (personal communication, November 17, 2003, with Sherman Wiseman, Transportation Survey, Wyoming Department of Transportation [WDOT]). U.S. Highway 191 recently has been improved over much of its length between Interstate 80 (I-80) and State Highway 351, and a turnout at the Luman Road junction has been developed. No future JIDPA access points along U.S. Highway 191 are anticipated; however, turnout lanes may be deemed appropriate at the junction of U.S. Highway 191 and the Rim Road. Additionally, any potential new access roads junctions would be developed in consideration of sight distances and may require turnout lanes. These actions would be coordinated with the WDOT. Special arrangements would be made with WDOT to place road signs along this road to increase awareness of potential driving hazards and increase employee and public safety. These signs may include, but would not be restricted to, school bus stops, up-coming turn markers (i.e., Luman Road and Rim Road), animal crossings, etc.

A-3.2 WYOMING STATE HIGHWAY 351

Wyoming State Highway 351 runs east/west approximately 6 miles north of the JIDPA. This road provides access to the JIDPA via the Burma and Jonah North Roads primarily for the traffic traveling from the Big Piney/Marbleton area. State Highway 351 traffic has increased from 700 vehicles a day in 2002 to 1,200 vehicles a day in 2003 and is scheduled for improvement in 2010 (personal communication, September 9, 2003, with Bob Maxam, Resident Engineer, WDOT, Pinedale). Turnout lanes and sight distances would be considered at the Burma Road and Jonah North Road junctions and at any future access points, and this action would be coordinated with WDOT. Special arrangements would be made with WDOT to place road signs along this road to increase awareness of potential driving hazards and increase employee and public safety. These signs may include, but would not be restricted to, school bus stops, up-coming turnmarkers (i.e., Burma Road and Jonah North Road), animal crossings, etc.

A-3.3 LUMAN ROAD

The existing unpaved Luman Road links the JIDPA to U.S. Highway 191 east of the area and is the primary field access route. This road is a local/collector road, is gravel/aggregate-surfaced, and is regularly treated with magnesium chloride from its junction with U.S. Highway 191 through the JIDPA. The Luman Road has been improved through the JIDPA and continues to the southwest to its junction with the existing County Line Road. Access to the JIDPA from the southwest would be restricted to the Whelan Bridge near LaBarge to avoid increased traffic in Reardon and Chapel Canyons. Additional improvement and maintenance work on the Luman Road would be performed by operators under the jurisdiction of the BLM. It is anticipated that, at field abandonment, the Luman Road would remain in an upgraded condition. Multiple subsurface gas sales pipelines currently exist along the Luman Road. These pipelines may be replaced with larger pipelines or additional pipelines may be constructed. Since no new pipelines are currently proposed from the JIDPA, further pipeline development would require another environmental analysis.

A-3.4 BURMA ROAD

The Burma Road extends from Wyoming State Highway 351 12 miles south to the JIDPA. An upgrade to the Burma Road to allow for additional access to the field from the northwest is being considered for this project. Upgrade improvements would likely include straightening, widening, and surfacing. Additionally, the approach to State Highway 351 would be widened and paved, and a new cattle guard and culvert would be installed. Improvements would be planned and built according to BLM standards. At field abandonment, the entire route would be reclaimed to conditions approximating those currently existing in the area unless there is an identified need for the improved road by other area users.

A-3.5 JONAH NORTH ROAD

The Jonah North Road begins at Wyoming State Highway 351 (approximately 4.7 miles west from the U.S Highway 191 junction) and extends 7 miles south into the JIDPA. This road has collector road status and has been gravel/aggregate-surfaced. No further improvements are currently scheduled, and any additional road upgrades/improvements would be planned and built according to BLM standards under the analyses provided in the Pinedale Anticline EIS (BLM 2000). The road is regularly treated with magnesium chloride to control fugitive dust. At field abandonment, the entire route would be reclaimed unless there is an identified need for the improved road by other area users.

A-3.6 RIM ROAD

The Rim Road serves as a connector road between the Jonah North Road and U.S. Highway 191 approximately 2.4 miles south from the Wyoming State Highway 351 junction. This road has resource road status and has been gravel/aggregate-surfaced but does not receive regular maintenance. The road is not intended for oil and gas development traffic, and its primary purpose is to provide for livestock management and recreation traffic. No improvements are currently scheduled, and any additional road upgrades or improvements would be planned and built according to BLM standards, under the analyses provided in the Pinedale Anticline EIS (BLM 2000). The road is treated with magnesium chloride to control fugitive dust. To preclude oil and gas development traffic from the road, signs may be posted indicating closure to oil field traffic and/or the cattle guard at U.S. Highway 191 may be replaced with a gate. At field abandonment, the entire route would be reclaimed unless there is an identified need for the improved road by other area users.

A-3.7 ADDITIONAL LOCAL AND RESOURCE ROADS AND GATHERING PIPELINES

Additional local and resource roads and gathering pipelines would be constructed in the JIDPA as necessary to accommodate new wells, and these routes would be specified in annual operational updates. Where any new roads are shown to duplicate existing two-track roads, the existing two-track would be reclaimed unless it is deemed necessary for other area activities (e.g., livestock operations). At field abandonment, it is anticipated that most, if not all, newly constructed local and resource roads would be reclaimed unless there is an identified need for the road by other area users.

A-4.0 EXISTING AND PROPOSED TRANSPORTATION NEEDS

A-4.1 THE EXISTING NETWORK

The existing transportation network on the TPA is shown on Map A-1.1. This system includes four primary access roads: the Luman Road that connects the JIDPA to U.S. Highway 191 east of the JIDPA and the County Line Road southwest of the area; the Burma Road that runs north from the JIDPA to State Highway 351; and the Jonah North Road that connects the northeastern edge of the field north to State Highway 351. Historic use of the roads has been limited primarily to livestock operators and recreationists (e.g., hunters, off-road vehicle (ORV) users). The principle current use of these and other roads in the area is for oil- and gas-related traffic. The existing transportation system is generally suitable for all current users.

The Luman Road is utilized by all user groups, receives more use by large vehicles than any other road on the area, and is the most heavily used road in the area. Most use of the Luman Road occurs in the JIDPA and eastward to U.S. Highway 191; however, access from the southwest is suited for all-weather traffic. Vehicles currently traveling the route from the southwest may access the route from Whelan Bridge in LaBarge or from Five Mile Bridge south of Big Piney and east up Reardon or Chapel Canyons. Existing traffic primarily uses the Whelan Bridge. Most of the heavy vehicle traffic in the JIDPA travels the Luman Road to U.S. Highway 191 and is for oil- and gas-related activities.

The Burma Road is traversed by all users but is currently not well suited for all-weather travel or large vehicles. The road receives less use than the Luman Road; however, there is a moderate amount of heavy truck use during dry weather.

The Jonah North Road is traversed by all users as an all-weather travel and large vehicle access route. The road receives less use than the Luman Road; however, there is a moderate amount of heavy truck use during dry weather.

Undesignated two-track roads also may be used for access. These routes are used primarily by grazing permittees and recreationists and are prohibited for use by Operators except in emergencies. Grazing permittees primarily use the two-tracks to access water developments.

A-4.2 PROPOSED NETWORK USE OR MODIFICATION

The typical stages of a trip necessary for use of the JIDPA transportation system are listed below:

- main movement (i.e., U.S. and state highway lanes for workers with destinations terminating in the JIDPA);
- transition (i.e., turnout lanes, where there is a change in travel speed);
- distribution/collection (i.e., oil/gas field unit or ranch access roads, collector and local roads); and
- terminal access (i.e., well location access roads, resource roads).

When planning transportation facilities, all of the described traffic stages can be identified within the system, but any stage could be eliminated if not needed (e.g., intermediate stages may not be necessary). Each movement stage is handled by a separate facility designed specifically for its function. Identifying the stages helps to plan traffic flows.

The TPA transportation network may experience problems at traffic stage changes due to the relatively high volume of expected traffic. Estimated traffic requirements for the Jonah Infill Drilling Project are provided in Tables A-4.1 through A-4.8 and are summarized in Table A-4.9. Construction, drilling, and completion activities have the greatest traffic requirements (an estimated 810 to 850 round trips per well over a 90- to 94-day period). For the entire field, average daily traffic during development is expected to range from 172 to 189 vehicles per day primarily on the Luman Road (Table A-4.10). All well development activities are anticipated to require from 5 to 42 years to complete depending upon the total number of wells developed and the pace of development (Table A-4.11).

Table A-4.1 Vehicle Characteristics and Number of Trips for a 3,100 Wells on 3,100 New Well Pads Project.

Construction Activities/Vehicle	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad/Access Road						
Gravel/Haul Trucks[3]	35	18	20	15	8	24,800
Light trucks/Pickups[3]	7	4	30	20	12	37,200
Drilling (vertical)						
Semi	44 (28-60)	18	20	15	140	434,000
Logging/Mud Trucks	48	10	20	15	10	31,000
Roustabouts	20	6	30	20	20	62,000
Vendors/Marketers[4]	7	4	30	20	30	93,000
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	1,085,000
Large Haul Trucks	48	10	20	15	50	155,000
Small Haul Trucks	20	6	20	15	30	93,000
Light Trucks/Pickup	7	4	30	20	140	434,000
Pipeline Construction						
Haul Trucks[5]	54 (28-80)	18	20	15	8	24,800
Light trucks/Pickups[5]	7	4	30	20	12	37,200
Subtotal Development					810	2,511,000
Production Activities						
Workover Rig	90	18	20	15	3	9,300
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	5,425,000
Light Trucks/Pickups[7]	7	4	30	20	243	753,300
Subtotal Production					1,996	6,187,600
Total[8]					2,806	8,698,600

1 Loaded and empty weights provided in parentheses.
2 Based on 3,100 new well pads and 3,100 new wells.
3 Based on 3,100 new well pads and access roads.
4 Based on 300 round trips/well with 10 wells visited/trip.
5 Based on one pipeline/well.
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 20 wells visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.2 Vehicle Characteristics and Number of Trips for a 3,100 Wells on No New Well Pads Project.

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad Expansion						
Gravel/Haul Trucks[3]	35	18	20	15	4	2,000
Light trucks/Pickups[3]	7	4	30	20	6	3,000
Drilling (Directional)						
Semi	44 (28-60)	18	20	15	168	520,800
Logging/Mud Trucks	48	10	20	15	12	37,200
Roustabouts	20	6	30	20	24	74,400
Vendors/Marketers[4]	7	4	30	20	36	111,600
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	1,085,000
Large Haul Trucks	48	10	20	15	50	155,000
Small Haul Trucks	20	6	20	15	30	93,000
Light Trucks/Pickup	7	4	30	20	140	434,000
Pipeline Construction						
Gravel/Haul Trucks[5]	54 (28-80)	18	20	15	8	4,000
Light trucks/Pickups[5]	7	4	30	20	12	6,000
Subtotal Development					840	2,526,000
Production Activities						
Workover Rig	90	18	20	15	3	9,300
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	5,425,000
Light Trucks/Pickups[7]	7	4	30	20	487	242,000
Subtotal Production					2,240	5,676,300
Total[8]					3,080	8,202,300

1 Loaded and empty weights provided in parentheses.
2 Based on 497 existing well pads and 3,100 new wells.
3 Based on expansion of 497 existing well pads.
4 Based on 300 round trips/well with 10 wells visited/trip.
5 Based on one new pipeline/existing wellpad.
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 10 well pads (about 6 wells/pad) can be visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.3 Vehicle Characteristics and Number of Trips for a 1,250 Wells on 1,250 New Well Pads Project.

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad/Access Roads						
Gravel/Haul Trucks[3]	35	18	20	15	8	10,000
Light trucks/Pickups[3]	7	4	30	20	12	15,000
Drilling (vertical)						
Semi	44 (28-60)	18	20	15	140	175,000
Logging/Mud Trucks	48	10	20	15	10	12,500
Roustabouts	20	6	30	20	20	25,000
Vendors/Marketers[4]	7	4	30	20	30	37,500
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	437,500
Large Haul Trucks	48	10	20	15	50	62,500
Small Haul Trucks	20	6	20	15	30	37,500
Light Trucks/Pickups	7	4	30	20	140	175,000
Pipeline Construction						
Gravel/Haul Trucks[5]	54 (28-80)	18	20	15	8	10,000
Light trucks/Pickups[5]	7	4	30	20	12	15,000
Subtotal Development					810	1,012,500
Production Activities						
Workover Rig	90	18	20	15	3	800
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	2,187,500
Light Trucks/Pickups[7]	7	4	30	20	243	303,800
Subtotal Production					1,996	2,495,100
Total[8]					2,806	3,507,600

1 Loaded and empty weights provided in parentheses.
2 Based on 1,250 new well pads and 1,250 new wells.
3 Based on 1,250 new well pads and access roads.
4 Based on 300 round trips/well with 10 wells visited/trip.
5 Based on one pipeline/wellpad.
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 20 wells visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.4 Vehicle Characteristics and Number of Trips for a 2,200 Wells on 2,200 New Well Pads Project.

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad/Access Road						
Gravel/Haul Trucks[3]	35	18	20	15	8	17,600
Light trucks/Pickups[3]	7	4	30	20	12	26,400
Drilling (vertical)						
Semi	44 (28-60)	18	20	15	140	308,000
Logging/Mud Trucks	48	10	20	15	10	22,000
Roustabouts	20	6	30	20	20	44,000
Vendors/Marketers[4]	7	4	30	20	30	66,000
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	770,000
Large Haul Trucks	48	10	20	15	50	110,000
Small Haul Trucks	20	6	20	15	30	66,000
Light Trucks/Pickups	7	4	30	20	140	308,000
Pipeline Construction						
Gravel/Haul Trucks[5]	54 (28-80)	18	20	15	8	17,600
Light trucks/Pickups[5]	7	4	30	20	12	26,400
Subtotal Development					810	1,782,000
Production Activities						
Workover Rig	90	18	20	15	3	6,600
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	3,850,000
Light Trucks/Pickups[7]	7	4	30	20	243	534,600
Subtotal Production					1,996	4,450,600
Total[8]					2,806	6,232,600

1 Loaded and empty weights provided in parentheses.
2 Based on 2,200 new well pads and 1,250 new wells.
3 Based on 2,200 new well pads and access roads.
4 Based on 300 round trips/well with 10 wells visited/trip.
5 Based on one pipeline/wellpad.
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 20 wells visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.5 Vehicle Characteristics and Number of Trips for a 3,100 Wells on 266 New Well Pads Project.

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad Expansion						
Gravel/Haul Trucks[3]	35	18	20	15	4-8	4,100
Light trucks/Pickups[3]	7	4	30	20	6-12	6,200
Drilling (Directional)						
Semi	44 (28-60)	18	20	15	168	520,800
Logging/Mud Trucks	48	10	20	15	12	37,200
Roustabouts	20	6	30	20	24	74,400
Vendors/Marketers[4]	7	4	30	20	36	111,600
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	1,085,000
Large Haul Trucks	48	10	20	15	50	155,000
Small Haul Trucks	20	6	20	15	30	93,000
Light Trucks/Pickups	7	4	30	20	140	434,000
Pipeline Construction						
Gravel/Haul Trucks[5]	54 (28-80)	18	20	15	8	6,100
Light trucks/Pickups[5]	7	4	30	20	12	9,200
Subtotal Development					850	2,536,600
Production Activities						
Workover Rig	90	18	20	15	3	9,300
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	5,425,000
Light Trucks/Pickups/ Pumpers[7]	7	4	30	20	487	371,600
Subtotal Production					2,240	5,805,900
Total[8]					3,090	8,342,500

1 Loaded and empty weights provided in parentheses.
2 Based on 266 new well pads and 3,100 new wells.
3 Based on 266 new well pads and access roads, and well pad expansion at the 497 existing pads.
4 Based on 360 round trips/well with 10 wells visited/trip.
5 Based on one pipeline/wellpad (includes 266 new and 497 existing pads; 763 total).
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 10 well pads (about 5 wells/pad) visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.6 Vehicle Characteristics and Number of Trips for a 3,100 Wells on 1,028 New Well Pads Project.

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad/Access Road						
Gravel/Haul Trucks[3]	35	18	20	15	4-8	10,200
Light trucks/Pickups[3]	7	4	30	20	6-12	15,300
Drilling (Directional)						
Semi	44 (28-60)	18	20	15	168	520,800
Logging/Mud Trucks	48	10	20	15	12	37,200
Roustabouts	20	6	30	20	24	74,400
Vendors/Marketers[4]	7	4	30	20	36	111,600
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	1,085,000
Large Haul Trucks	48	10	20	15	50	155,000
Small Haul Trucks	20	6	20	15	30	93,000
Light Trucks/Pickups	7	4	30	20	140	434,000
Pipeline Construction						
Gravel/Haul Trucks[5]	54 (28-80)	18	20	15	8	12,200
Light trucks/Pickups[5]	7	4	30	20	12	18,300
Subtotal Development					850	2,567,000
Production Activities						
Workover Rig	90	18	20	15	3	9,300
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	5,425,000
Light Trucks/Pickups[7]	7	4	30	20	487	742,700
Subtotal Production					2,240	6,177,000
Total[8]					3,090	8,744,000

1 Loaded and empty weights provided in parentheses.
2 Based on 1,028 new well pads and 3,100 new wells.
3 Based on 1,028 new well pads and access roads, and well pad expansion at the 497 existing pads.
4 Based on 360 round trips/well with 10 wells visited/trip.
5 Based on one new pipeline/wellpad (includes 1,028 new and 497 existing pads; 1,525 total).
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 10 well pads (about 3 wells/pad) visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.7 Vehicle Characteristics and Number of Trips for a 3,100 Wells on 2,553 New Well Pads Project.

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well Pad or Well	Total Project Round Trips[2]
Well Pad/Access Road						
Gravel/Haul Trucks[3]	35	18	20	15	4-8	22,400
Light trucks/Pickups[3]	7	4	30	20	6-12	33,600
Drilling (vertical)						
Semi	44 (28-60)	18	20	15	140	434,000
Logging/Mud Trucks	48	10	20	15	10	31,000
Roustabouts	20	6	30	20	20	62,000
Vendors/Marketers[4]	7	4	30	20	30	93,000
Completion Traffic						
Semi/Transport/Water/ Sand	54 (28-80)	18	20	15	350	1,085,000
Large Haul Trucks	48	10	20	15	50	155,000
Small Haul Trucks	20	6	20	15	30	93,000
Light Trucks/Pickups	7	4	30	20	140	434,000
Pipeline Construction						
Gravel/Haul Trucks[5]	54 (28-80)	18	20	15	8	24,400
Light trucks/Pickups[5]	7	4	30	20	12	36,600
Subtotal Development					810	2,504,000
Production Activities						
Workover Rig	90	18	20	15	3	9,300
Haul Trucks[6]	54 (28-80)	10	20	15	1,750	5,425,000
Light Trucks/Pickups[7]	7	4	30	20	243	753,300
Subtotal Production					1,996	6,187,600
Total[8]					2,806	8,691,600

1 Loaded and empty weights provided in parentheses.
2 Based on 2,553 new well pads and 3,100 new wells.
3 Based on 2,553 new well pads and access roads, and well pad expansion at the 497 existing pads.
4 Based on 360 round trips/well with 10 wells visited/trip.
5 Based on one new pipeline/wellpad.
6 Includes water and condensate hauling.
7 Assumes all wells visited every 3 days, approximately 20 wells visited daily, and a 40-year well life.
8 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.8 Vehicle Characteristics and Number of Trips for a 533 Wells on 497 Well Pads Project (No New Wells).

Construction Activities	Average Weight x 1000 lbs[1]	No. of Wheels	Average Speed on Collector Road	Average Speed on Resource Road	Round Trips Per Well	Total Project Round Trips[2]
Production Activities						
Workover Rig	90	18	20	15	3	1,600
Haul Trucks[3]	54 (28-80)	10	20	15	1,750	932,800
Light Trucks/Pickups[4]	7	4	30	20	243	129,500
Total[5]					1,996	1,063,900

1 Loaded and empty weights provided in parentheses.
2 Based on the existing authorization for 497 well pads and 533 wells.
3 Includes water and condensate hauling.
4 Assumes all wells visited every 3 days, approximately 20 wells visited daily, and a 40-year well life.
5 Some additional low-volume traffic would also be necessary for reclamation activities.

Table A-4.9 Estimated Traffic Requirements Summary, All Development Scenarios, Jonah Infill Drilling Project, Sublette County, Wyoming.

Type of Traffic	Round Trips per Well	LOP Round Trips (Thousands)[1]	Average Daily Traffic[1]
Well Construction and Development			
Well Pad and Access Road Construction (4 days/well site)[2]	10-20	5-62	--
Drilling (22-26 day average)[3]	200-240	250-744	--
Completion/Testing (60 days)	570	713-1,767	--
Pipeline Construction (4 days)	20	10-62	--
Total well construction and development (90-94 days/well site; 5-42 years for the project)	810-850	978-2,635	32-172
New Production Activities[4]	1,996-2,240	2,495-6,188	171-424
Existing Production Activities[4]	--	1,064	73
Total[5]	2,806-3,090	4,537-9,887	146-564

1 Assumes 1,250 to 3,100 new wells are drilled and completed as producers, wells produce every day, development actions would be completed in from 5 to 42 years, well life is 40 years, and LOP is from 48 to 85 years (includes the final 3 years of reclamation).
2 Includes gravel hauling.
3 Includes rig move; average varies from 22 days for a vertical well to 26 days for a directional well.
4 Assumes one pumper can visit 20 wells/day, one pad every 3 days, and average well life is 40 years.
5 Average daily traffic volumes are not additive.

Table A-4.10 Approximate Traffic Volumes for Selected Roads, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

	Approximate Number of Round Trips[2]			Approximate Average Daily Traffic[3]		
Road Type (Number of Wells)	Development	Production	Total	Development	Production	Total
Resource Road (1 well)[2]	810-850	1,996-2,240	2,806-3,090	9-10	0.1-0.2	0.1-0.2
Resource Road (10 wells)	8,100-8,500	19,960-22,400	28,060-30,900	86-94	1.4-1.5	0.9-1.8
Collector/Local Roads (50 wells)	40,500-42,500	99,800-112,000	140,300-154,500	172-189	6.8-7.7	4.5-8.8
Collector/Local Roads (100 wells)	81,000-85,000	199,600-224,000	280,600-309,000	172-189	13.7-15.3	9.0-17.6
Collector/Local Roads (500 wells)	405,000-423,000	998,000-1,120,000	1,403,000-1,545,000	172-189	68.4-76.7	45.2-88.2
Luman Road (1,747 wells)[4]	1,012,500-1,062,500	3,487,000-3,913,300	4,499,500-4,975,800	172-189	239-268	145-284
Luman Road (2,697 wells)[5]	1,782,000-1,870,000	5,383,200-6,041,300	7,165,200-7,911,300	172-189	369-414	231-452
Luman Road (3,597 wells)[6]	2,511,000-2,635,000	7,179,600-8,057,300	9,690,600-10,692,300	172-189	492-552	312-610

1 Summarized for all development alternatives.
2 See Tables A-4.1 through A.4.7.
3 Assumes a development period of 90 to 94 days per well and 20 simultaneous development operations, a productive well life of 40 years, and a LOF of 43 to 85 years (see Table A-4.11).
4 1,250 new and 497 existing wells; no development actions would occur for the 497 existing wells.
5 2,250 new and 497 existing wells; no development actions would occur for the 497 existing wells.
6 3,100 new and 497 existing wells; no development actions would occur for the 497 existing wells. Approximates maximum project traffic.

Table A-4.11 Estimated Life-of-Project (Years), Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

Project Phase/Rate	No New Wells	1,250 Wells	2,200 Wells	3,100 Wells
Development				
75 wells drilled/year	0	17	30	42
150 wells drilled/year	0	9	15	21
250 wells drilled/year	0	5	9	13
Total Development	0	5-17	9-30	13-42
Production	40	40	40	40
Reclamation	3	3	3	3
Life-of-Project	43[1]	48-60	52-73	56[2]-85

[1] No New Wells.
[2] Proposed Action LOP.

Localized construction and drilling activity would temporarily place heavy demands on road servicing. Traffic demands would be high in areas where drilling and completion activities are occurring throughout the development period (5 to 42 years) but would be reduced within other areas of the JIDPA and once development is completed. Once all wells have been developed, traffic requirements would remain high for the remainder of the LOP (i.e., averaging between 492 to 552 vehicles per day) (Table A-4.10). JIDPA roads would be used continually until all wells in the area are abandoned and disturbed areas reclaimed. For the entire LOP under the various potential development scenarios (i.e., 43 to 85 years) overall traffic requirements are anticipated to range from 312 to 610 vehicles per day (Table A-4.10).

A-4.3 ULTIMATE ROAD DISPOSITION

When the field is ready for abandonment (estimated to be approximately 43 to 85 years from authorization), the transportation network within the TPA would be reclaimed to appear much as it did prior to development. Roads identified as necessary or desirable for other area users (e.g., grazing permittees, recreationists) may be retained with improvements.

Resource roads that may be retained after the LOP would be those that were identified during transportation planning as duplicating an existing two-track or other low-traffic-volume road, for which these two-tracks or other roads were reclaimed. In addition, resource roads that are deemed necessary by the BLM for other area uses also may be retained.

The Luman and Burma Roads likely would be retained after project completion in an upgraded status. All other project-required roads are anticipated to be entirely reclaimed or returned to conditions similar to those occurring on the area prior to development.

Road use following project completion likely would be limited to two of the three existing uses (i.e., grazing management and recreation), and responsibility for maintenance of roads would revert back to the BLM. A determination regarding the extent of post-project road maintenance (e.g., winter snow removal) cannot be determined at this time since the level of future area use is unknown. Decisions would be made during the later years of the project based on public input.

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A-5.0 ROAD CLASSIFICATIONS

A-5.1 FUNCTIONAL ROAD CLASSIFICATION, GENERAL

The general functional road classification used in this document classifies roads according to a hierarchy of traffic movement within a traffic system. This classification is described in BLM Manual Section 9113 (BLM 1985) and does not necessarily depend on road condition.

A-5.2 FUNCTIONAL ROAD CLASSIFICATION

The road classification system used in this document is based on the one currently used by the BLM. The special attributes of the roads within the TPA require the use of multiple collector roads.

The road classification described below is derived from the BLM Manual Section 9113 (BLM 1985, 1991).

- Local/Collector Roads. These roads normally provide primary access to large blocks of land and connect with or are extensions of a public road system. They also usually provide the internal access network within an oil and gas field. Local/collector roads usually require application of the highest standards used by the BLM. The road design speed is 20-50 mph. The Luman, Burma, Jonah North, and three additional in-field roads are identified as local/collector roads for this project (see Map A-1.1).

- Resource Roads. These normally are spur roads that provide point access. Roads servicing individual oil and gas well locations usually fall within this classification. These roads have a design speed of 15-30 mph and are often constructed with intervisible turnouts.

- Casual Use Routes. Casual use routes are those that have not been constructed or maintained. They are usually created by repeated travel along the same route over time and are often called two-tracks.

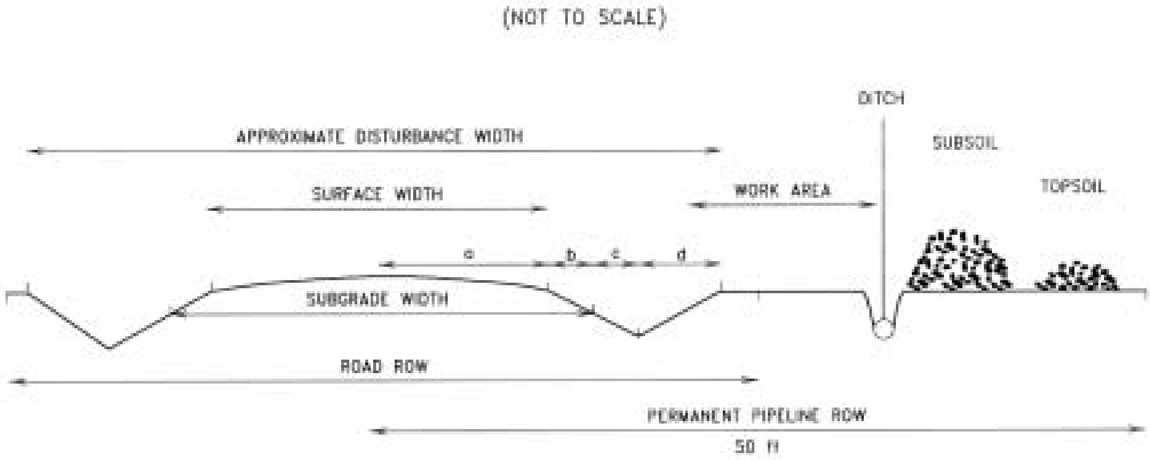
The public local/collector roads in the JIDPA include the three main BLM roads: the Luman, Burma and Jonah North Roads. There are also numerous undesignated casual routes (unimproved/two-track roads) on the area and Operator-maintained well access (resource) roads (see Map A-1.1).

Some of the existing casual routes within the JIDPA may be upgraded and used as resource or local roads for natural gas development activities. Future resource roads (i.e., low-traffic-volume roads) are not specifically identified in this document due to the lack of site-specific details for the proposed project. Resource roads and future local roads would be identified during localized area transportation planning and would be specified in annual operational updates.

Proposed high-traffic-volume roads and/or road corridors (collector and local roads) are identified within this document (see Map A-1.1) and on maps available for review at area BLM offices. Resource roads that currently provide access to one or more existing wells or other facilities are also shown on the maps.

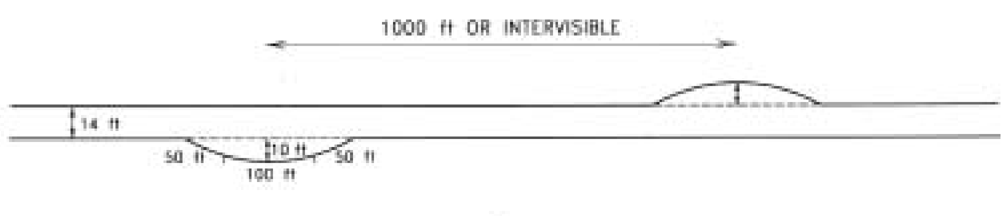
Operational updates would be used to determine the type of road standard and design parameters for new and/or upgraded roads. Design parameters for the road types proposed for this project (i.e., local/collector, and resource roads) are shown in Figure A-5.1 and would be commensurate with BLM 9113 Manual specifications (BLM 1985, 1991). No roads required for this project would have travel surface widths of less than 29 ft.

All roads upgraded or developed for this project would be designed, constructed, and surfaced to provide all-weather access. However, some local and resource roads initially may be constructed without appropriate surfacing material and, therefore, may become impassable during inclement weather. Operators would assume the risk of denied access to facility sites during inclement weather on roads that become impassable, since the BLM may deny access to avoid resource damage during periods when roads are unsuitable for travel.



	MINIMUM SUBGRADE WIDTH (ft)	MINIMUM SURFACED TRAVELWAY WIDTH (ft)	a (ft)	b (ft)	c (ft)	d (ft)	APPROXIMATE DISTURBANCE WIDTH (ft)	ROW WIDTH (ft)	DESIGN SPEED (mph)
RESOURCE ROAD	16	12	6	2	4	8	40	50	15–30
LOCAL ROAD	24	20	10	2	4	8	48	55	20–50
COLLECTOR ROAD	28	24	12	2	4	8	52	60	30–50

DIAGRAM OF TYPICAL TURNOUTS ON RESOURCE ROADS



35982\EIS\FIGURE\TYP-ROAD

Figure A-5.1 Typical Access Road (Local/Collector and Resource) with Adjacent Pipeline Schematic, Jonah Infill Drilling Program, Sublette County, Wyoming, 2004.

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A-6.0 ENVIRONMENTAL CONSTRAINTS

There are many natural obstacles (e.g., steep slopes, poor soils for road construction, sensitive resources) throughout the TPA that pose problems for road construction and development. This section discusses several of the more formidable obstacles. Additional areas of concern may be identified during transportation planning and during APD or ROW application review processes. Although roads could be constructed through many of the obstacles, these areas would be avoided, where possible, to avoid resource conflicts and augmented construction costs. The maps available for review at area BLM offices show the locations of the following natural and/or physical obstacles.

A-6.1 TOPOGRAPHIC CONSTRAINTS

In addition to the topographic obstacles listed below, there are many small dry lake beds and low-lying areas, small drainage channels, rock outcroppings, steep slopes, etc., that would be considered when choosing transportation routes within and adjacent to the TPA.

A-6.1.1 Steep Slope Areas

Steep slope areas occur throughout the TPA, and these areas would be avoided where possible to minimize erosion, visual resource, and biological resource impacts. Notable steep slope areas present in the TPA include Blue Rim, Stud Horse and Teakettle Buttes, and Ross and Yellow Point Ridges (see maps available at area BLM offices).

A-6.1.2 Playas

Two playas are known to occur on the TPA. Playas would be avoided where possible during construction to protect these special landscape features.

A-6.1.3 Large Drainages

Crossing drainages is expensive and can cause adverse impacts if crossings are not appropriately designed and constructed. When it is necessary to cross a large drainage, an appropriate bridge, culvert, or low water crossing would be selected and designed to handle at least a 10-year flood. In addition, drainages and adjacent areas often contain significant cultural resource sites. The number of drainage crossings would be scrupulously limited; to the extent practicable, no new crossings would be constructed. Large drainages within the TPA include Sand Draw, North Alkaline Draw, Granite Wash, East and West Buckhorn Draws, and Long Draw.

A-6.2 SOIL CONSTRAINTS

Site investigations and soil evaluations provide valuable information on soil types and limitations of the materials encountered on a road project. The extent of sampling and testing work required depends on the type and size of the road and soils characteristics. Lower-standard roads (e.g., some resource roads) generally would not require soil investigations. Visual examination is generally sufficient for low-traffic-volume roads that would not carry frequent heavy loadings and for roads that appear to have soil types well-suited to road construction. Soils that generally cause problems are loose windblown sand, silt, and clay (fine-grained materials without the presence of gravel or rocky material). Fine-grained silts or clays are particularly troublesome when saturated. Sands cause problems when dry.

Sands, silts, and clays may be difficult to distinguish when in combination, and intermediate silts have some characteristics of both sands and clays. Roads constructed on poor soils may perform well immediately after construction but may lose stability by bearing failure (sand) or become too slippery or unable to support loads (clay) when wet. Road surfacing (e.g., gravel, pavement, etc.) can mitigate road placement on poor soils.

Classifying soil types at proposed construction sites is valuable in predicting potential surface damage and in determining the need for and type of surfacing material (Tables A-6.1 to A-6.4). Laboratory testing to determine the structural values of the soil may be advisable on roads

Table A-6.1 Criteria to Establish Soil Suitability for Drastically Disturbed Areas.[1]

	Rating[2]			
Parameter	Good	Fair	Poor	Restrictive Feature
Soil reaction (pH)	5.6-7.8	5.0-5.5 8.5-9.0	<5.0 >9.0	Too acid Too alkaline
Salinity (mmhos/cm)	0-8	8-16	>16 >8	Excess salt
Depth to cemented pan (inches)	>40	20-40	<20	Reclamation problems
Texture[3]	SL, L, SIL, SCL, VFSL, FSL, CL, SICL (<35% C)	CL, SICL, SC LS, LFS, LVFS	C, SIC, S, FS, VFS	Too clayey Too sandy
Soil adsorption ratio	0-5	5-12	>12	Excess sodium
Depth to bedrock (inches)	>40	20-40	<20	Reclamation problems
Erosion factor	<0.35	>0.35	>0.35	Erodes easily
Wind erodability group			1, 2	Soil blowing
Coarse fragments (% wt)				
3-10 inches	0-15	15-35	>35	Small stones
>10 inches	0-3	3-10	>10	Large stones, reclamation problems

[1] Adapted from Soil Survey Staff (1983).

[2] A rating of good means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated fair can be vegetated and stabilized by modifying one or more properties. Topdressing with better material or application of soil amendments may be necessary for satisfactory performance. Material rated poor has such severe problems that revegetation and stabilization are very difficult and costly. Topdressing with better material is necessary to establish and maintain vegetation.

[3] U.S. Department of Agriculture Texture.

C	Clay	S	Sand
CL	Clay loam	SC	Sandy clay
FS	Fine sand	SCL	Sandy clay loam
FSL	Fine sandy loam	SIC	Silty clay
L	Loam	SICL	Silty clay loam
LFS	Loamy fine sand	SIL	Silt loam
LS	Loamy sand	SL	Sandy loam
LVFS	Loamy very fine sand	VFS	Very fine sand
		VFSL	Very fine sandy loam

Table A-6.2 Criteria Used to Establish Suitability for Pond/Reservoir Areas.[1]

	Limits			
Property	Slight	Moderate	Severe	Restrictive Feature
Texture[2]	SIC, C, SICL, CL, SC, SCL	L, SICL, CL, SIL, FSL, VFSL	SL, FSL, LS, S, LFS, gypsum	Seepage, piping
Permeability (inches/hr) (20-60 inches)	<0.6	0.6-2.0	>2.0	Seepage
Depth to bedrock (inches)	>60	20-60	<20	Depth to rock
Depth to cemented pan (inches)	>60	20-60	<20	Cemented pan
Slope (%)	0-3	3-8	>8	Slope

[1] Adapted from Soil Survey Staff (1983). Pond/reservoir areas are areas that hold water behind a dam or embankment and, for this project, include reserve pits. Soils best suited to this use have a low seepage potential, which is determined by permeability and depth to fractured or permeable bedrock, cemented pan, or other permeable material. The soil is rated on its properties in the upper 60 inches as a natural barrier against seepage into deeper layers, without regard to cutoff trenches or other features that may be installed under the reserve pit. Excessive slope in the direction perpendicular to the axis of the pond embankment seriously reduces the storage capacity of the reservoir area. Furthermore, suitable sites may be difficult to find on slopes steeper than about 10%.

[2] U.S. Department of Agriculture Texture.

C	Clay	SC	Sandy clay
CL	Clay loam	SCL	Sandy clay loam
FSL	Fine sandy loam	SIC	Silty clay
L	Loam	SICL	Silty clay loam
LFS	Loamy fine sand	SIL	Silt loam
LS	Loamy sand	SL	Sandy loam
S	Sand	VFSL	Very fine sandy loam

Table A-6.3 Criteria Used to Establish Suitability for Roadfill.[1]

	Limits			
Property	Slight	Moderate	Severe	Restrictive Feature
Depth to bedrock (inches)	>60	40-60	<40	Area reclaim
Texture[2]	--	L, SIL, FSL, VFSL, SCL, SC, SICL	CL, C, SIC	Low strength
Layer thickness (inches)	>60	30-60	<30	Thin layer
Fracture 3 inches (wt %)[3]	<25	25-50	>50	Large stones
Depth to high water table (ft)	>3	1-3	<1	Wetness
Slope (%)	0-15	15-25	>25	Slope
Shrink-swell	Low	Moderate	High	Shrink-swell

[1] Adapted from Soil Survey Staff (1983). Roadfill consists of soil material that is excavated from its original position and used in road embankments elsewhere. The evaluations for roadfill are for low embankments that generally are less than 6 ft in height and are less exacting in design than high embankments such as those along superhighways. The rating is given for the whole soil, from the surface to a depth of about 5 ft, based on the assumption that soil horizons will be mixed in loading, dumping, and spreading. Soils are rated as to the amount of material available for excavation, the ease of excavation, and how well the material performs after it is in place. Soil properties that affect the amount of material available for excavation are thickness of suitable material above bedrock or other material that is not suitable. The percent of coarse fragments more than 3 inches in diameter, the depth to a high water table, and the slope are properties that influence the ease of excavation. A high content of gypsum can cause piping or pitting. Some damage to the borrow area is expected, but if revegetation and erosion control are likely to be difficult, the soil is rated severe.

[2] U.S. Department of Agriculture Texture.

C	Clay	SCL	Sandy clay loam
CL	Clay loam	SIC	Silty clay
FSL	Fine sandy loam	SICL	Silty clay loam
L	Loam	SIL	Silt loam
SC	Sandy clay	VFSL	Very fine sandy loam

[3] Weighted average to 40 inches.

Table A-6.4 Criteria Used to Establish Suitability for Shallow Excavations.[1]

Factors Affecting Location and Use	Limits			Restrictive Feature
	Slight	Moderate	Severe	
Texture[2]	L, SIL, CL, SCL, SICL	SL, FSL, SI[3], SC, all gravelly types	C[4], SIC[4], S, LS, organic soils, all very gravelly types	
Soil drainage class	Excessive to well	Moderately well	Somewhat poorly to very poorly	Wetness
Depth to high water table (ft)	>6.0	2.5-6.0	<2.5	Ponding, wetness
Flooding	None, rare	None	Subject to flooding	Floods
Slope	<8%	8-15%	>15%	Slope
Depth to bedrock (inches)[5]	>60	40-60	<40	Depth to rock
Stoniness (classes)	0, 1	2	3, 4, 5	Stones
Rockiness (classes)	0	1	2, 3, 4, 5	Rocks

1 Adapted from Soil Survey Staff (1983).

2 U.S. Department of Agriculture Texture. If soil contains a thick fragipan, duripan, or other material difficult (but not impossible) to excavate with handtools, increase the limitation rating by one class unless it already is "severe."

C	Clay	SC	Sandy clay
CL	Clay loam	SCL	Sandy clay loam
FSL	Fine sandy loam	SI	Silt
L	Loam	SIC	Silty clay
LS	Loamy sand	SICL	Silty clay loam
S	Sand	SIL	Silt loam
		SL	Sandy loam

3 If soil will stand in vertical cuts like loess, reduce rating to "slight."

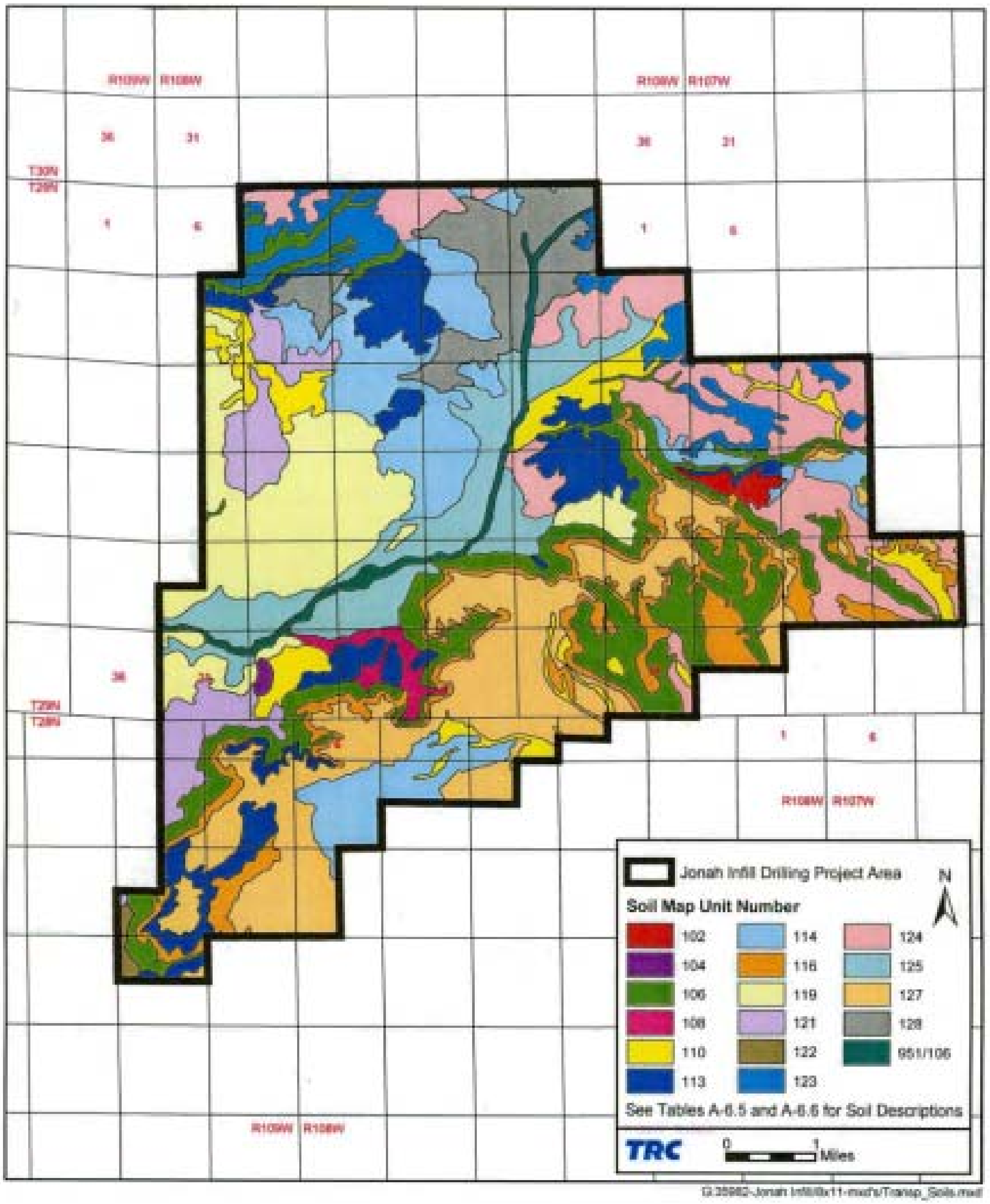
4 If friable like some kaolinitic clays, reduce rating to "moderate."

5 If bedrock is soft enough to excavate with ordinary handtools or light equipment such as a backhoe, reduce "moderate" and "severe" ratings by one class.

requiring high traffic volumes and/or repeated heavy loads. Soils would be classified prior to road construction and specified with appropriate construction criteria in operational updates and/or APD and ROW applications.

Soils present on the JIDPA are shown on Map A-6.1 and the detailed maps available at area BLM offices. Most soils within the TPA have limitations for road construction, shallow excavations associated with pipeline construction, pond/reservoir areas (reserve pits), and reclamation. Limitations were identified using criteria obtained from the U.S. Soil Conservation Service *National Soils Handbook, 603.15* (Soil Survey Staff 1983) (Tables A-6.1 through A-6.4).

Major soils within the JIDPA include the Vermillion Variant-Seedskadee-Fraddle complex on 0-3% slopes (Unit 127); Monte-Leckman complex on 1-6% slopes (Unit 106); the Fraddle-Ouard-San Arcacio Variant complex on 3-8% slopes (Unit 124); the Ouard-Ouard Variant-Boltus complex on 1-8% slopes (Unit 114); the Garsid-Monte Association on 1-6% slopes (Unit 119); the San Arcacio-Saguache association on 0-3% slopes (Unit 125); the Huguston-Horsley-Terada complex on 6-30% slopes (Unit 116); and the Haterton-Garsid complex on 1-8% slopes (Unit 113) (Table A-6.5). These mapping units collectively cover approximately 78% of the JIDPA. Primary limitations associated with these soils include thin soils, shallow depth to rock, low strength, sandiness, and stoniness (Tables A-6.5 and A-6.6). Steep slopes may limit development and reclamation potential in localized areas, but most soils are typically located on gently sloping, undulating uplands. The Cowestglen sand loam on 0-2% slopes (Unit 951/106) and the Monte-Leckman complex (Unit 106) on 1-6% slopes occur adjacent to drainage channels and on terraces and alluvial fans. These soils are limited by frost action, flooding, excess sand, and/or small stones.



Map A-6.1 Project Area Soils, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

Table A-6.5 Soil Types, Soil Use, and Management Considerations, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

Map Unit Number	Map Unit Name	Use and Management Considerations	Acres
102	Langspring Variant-Langspring complex, 1-10% slopes	Gently sloping to nearly level mesa tops and uplands. Loamy uplands. Generally suitable for road construction. Rehabilitation limited due to excess lime and small stones.	149
104	Chrisman silty clay, 0 to 2% slopes	Saline upland sites, in closed basins Construction activities limited due to severe shrink-swell properties. Rehabilitation potential limited by moderately alkaline soils.	42
106	Monte-Leckman complex, 1-6% slopes	Nearly level to gently sloping alluvial fans and drainageways. Loamy, saline uplands. Generally suitable for road construction. Rehabilitation limited by excess sands or small stones.	3,488
108	Dines-Clowers-Quealman complex, 0-3% slopes	Nearly level to gently sloping drainageways and alluvial terraces. Loamy sites, saline uplands. Limited for road construction due to low strength. Rehabilitation potential limited by excess salt, sand, and small stones.	268
110	Fraddle-Tresano complex, 1-8% slopes	Rolling uplands, upper dissected fans, and valley-filling slopes. Loamy uplands. Limited for construction activities and reclamation due to thin soils.	1,541
113	Haterton-Garsid complex, 1-8% slopes	Nearly level to gently sloping uplands and sideslopes. Shallow loamy and loamy sites. Construction limited by shallow depth to bedrock, slope, and low strength. Rehabilitation limited by shallow depth to bedrock and steep slopes.	2,102
114	Ouard-Ouard Variant-Boltus complex, 1-8% slopes	Nearly level to gently sloping uplands. Shallow loamy, shallow clayey, and shaley sites. Limited due to low strength and shallow depth to bedrock. Rehabilitation limited due to thin soils.	3,132
116	Huguston-Horsley-Terada complex, 6-30% slopes	Gently sloping to moderately steep sideslopes and rolling uplands. Shaley and loamy sites. Limited due to shallow depth to bedrock, low strength, and steep slopes. Rehabilitation limited by shallow depths and slopes.	2,109
119	Garsid-Monte association, 1-6% slopes	Gently undulating uplands. Loamy sites. Construction limited by thin soils, low strength, and steep slopes. Rehabilitation limited by steep slopes.	3,087
121	Garsid-Terada-Langspring Variant complex, 1-6% slopes	Undulating uplands. Loamy sites. Construction limited due to thin soils, low strength, and steep slopes. Rehabilitation limited by steep slopes, small stones, and excess lime.	1,261
122	Baston-Boltus-Chrisman association, 0-6% slopes	Undulating and dominantly concave uplands. Clayey, shaley, and saline upland sites. Construction limited by low strength, shrink-swell potential, thin soils, and steep slopes. Rehabilitation limited by thin soils, clayey textures, excess salt, and steep slopes.	85
123	Spool Variant-Ouard Variant-San Arcacio Variant complex, 4-25% slopes	Gently sloping to steep sideslopes and rolling uplands. Shallow sandy, shallow clayey, and loamy sites. Construction limited by shallow depth to bedrock and low strength. Rehabilitation limited by shallow depths, small stones, sandy or clayey textures, or steep slopes.	1,260
124	Fraddle-Ouard-San Arcacio Variant complex, 3-8% slopes	Rolling uplands. Loamy and shallow loamy sites. Construction limited by thin soils and low strength. Rehabilitation limited by thin soils, clayey textures, or small stones.	3,194
125	San Arcacio-Saguache association, 0-3% slopes	Old floodplains, fans, and terraces. Loamy and sandy sites. Generally suitable for road construction. Rehabilitation limited by small stones.	2,304
127	Vermillion Variant-Seedskadee-Fraddle complex, 0-3% slopes	Nearly level uplands and mesas. Shallow loamy and loamy sites. Limited for construction due to shallow depth to bedrock, low strength, and thin soils. Rehabilitation limited by stoniness, excess lime, and thin soils.	4,427
128	Fraddle-Ouard-San Arcacio Variant complex, 0-3% slopes	Nearly level upland surfaces. Loamy and shallow loamy sites. Construction limited by low strength and shallow depth to bedrock. Rehabilitation limited by thin soils and small stones.	1,645
951/106	Cowestglen sandy loam, 0 to 2% slopes/see also Map Unit 106, above	Nearly level drainage ways. Road construction potentially limited by moderate frost action and flooding. See also Map Unit 106.	406
Total			30,500

Table A-6.6 Soil Salvage Depth and Soil Characteristics for Project Area Soils, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
102	12	1-10%	Langspring Variant	Loamy	0-10	L	7.9-8.4	<2	Low
					10-22	CL, SCL, L, SL	8.5-9.0	<2	--
					22-30	SCL, L, SL	7.9-8.4	<2	--
					30+	Sandstone	--	--	--
			Langspring	Loamy	0-9	L	7.9-8.4	<2	Low
					9-26	SCL, L, SL	8.5-9.0	<2	--
					26-40	SCL, L, SL	7.9-8.4	<2	--
104	--	0-2%	Chrisman	Saline upland	0-2	SIC, C, SICL	7.9-9.0	<2	Low
					2-60	SIC, C, SICL	77.8	>4	Low
106	12	1-6%	Monte	Loamy/ saline upland	0-2 2-60	L CL, L, SL	6.6-9.0 7.9-9.0	<2 <2	Low --
			Leckman	Loamy/	0-3	FSL, VFSL	7.9-9.0	<2	Low
				saline upland	3-60	FSL, VFSL	7.9-9.0	<2	--
108	12	0-3%	Dines	Saline upland	0-4	SIL	>7.8	8-16	Low
					4-21	SIL, SICL	>8.4	8-16	--
					21-60	SIL, SICL	>8.4	>16	--
			Clowers	Loamy	0-1	L	7.9-9.0	4-8	Low
					1-60	CL	7.9-9.0	4-8	--
			Quealman	Loamy	0-2	FSL, L, CL	7.4-8.4	<2	Low
					2-60	SR-LS-L-FSL	7.9-9.0	<2	--
110	12	1-8%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--
			Tresano	Loamy	0-2	SL	6.6-7.8	<2	Low
					2-16	SCL	6.6-9.0	<2	--
					16-60	SL	7.4-8.4	2-4	--

Table A-6.6 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
113	12	1-8%	Haterton	Shallow loamy	0-3	L	7.9-9.0	2-4	Moderate
					3-12	L	7.9-9.0	2-4	--
					12+	Siltstone	--	--	--
			Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	Moderate
					22+	Shale	--	--	--
114	4	1-8%	Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	Low
					1-19	SCL	6.6-7.8	<4	--
					19+	Shale-sandstone	--	--	--
			Ouard Variant	Shallow clayey	0-4	CL, L	6.6-7.8	<2	Low
					4-16	CL, C	7.4-9.0	<2	--
					16+	Shale	--	--	--
			Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	Moderate
					11+	Shale	--	--	--
116	9	6-30%	Huguston	Shallow loamy	0-9	SL, FSL	7.4-8.4	2-4	Moderate
					9+	Soft sandstone	--	--	--
			Horsley	Shale	0-3	L	7.4-9.0	2-4	Moderate
					3-9	L, CL, SCL	7.4-9.0	<16	--
					9+	Shale	--	--	--
			Terada	Loamy	0-7	VFSL, FSL, LS	7.4-8.4	<2	Moderate
					7-34	VFSL, FSL	7.4-9.0	<2	--
					34+	Sandstone	--	--	--
119	12	1-6%	Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	Low
					22+	Shale	--	--	--
			Monte	Loamy	0-2	L	6.6-9.0	<2	Low
					2-60	CL, L, SL	7.9-9.0	<2	--
121	10	1-6%	Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	Low
					22+	Shale	--	--	--

Table A-6.6 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
			Terada	Loamy/sandy	0-7	VFSL, FSL, LS	7.4-8.4	<2	Low
					7-34	VFSL, FSL	7.4-9.0	<2	--
					34+	Sandstone	--	--	--
			Langspring Variant	Loamy	0-10	L	7.9-8.4	<2	Low
					10-22	CL, SCL, L, SL	8.5-9.0	<2	--
					22-30	SCL, L, SL	7.9-8.4	<2	--
					30+	Sandstone	--	--	--
122	0	0-6%	Baston	Clayey	0-3	FSCL	8.0-9.0	<2	Low
					3-28	C	>8.4	<4	--
					28+	Shale	--	--	--
			Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	Moderate
					11+	Shale	--	--	--
			Chrisman	Clayey/	0-2	SIC, C, SICL	7.9-9.0	<2	Low
				saline upland	2-60	SIC, C, SICL	>7.8	<4	--
123	4	4-25%	Spool Variant	Shallow sandy	0-6	LFS, GR-SL	6.6-7.3	<2	Moderate to high
					6-12	LFS, CN-LFS,	6.6-7.8	<2	--
						GR-SL, GR-S	--	--	--
					12+	Sandstone	--	--	--
			Ouard Variant	Shallow clayey	0-4	CL, L	6.6-7.8	<2	Moderate
					4-16	CL, C	7.4-9.0	<2	--
					16+	Shale	--	--	--
			San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	Low to moderate
					4-14	SCL, SL	6.1-8.4	<2	--
					14-25	LCOS, COS, GRV-S	6.6-8.4	<4	--
					25+	Soft sandstone	--	--	--
124	6	3-8%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low

Table A-6.6 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--
			Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	Low
					1-19	SCL	6.6-7.8	<4	--
					19+	Shale-sandstone	--	--	--
			San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	Low
					4-14	SCL, SL	6.1-8.4	<2	--
					14-25	LCOS, COS, GRV-S	6.6-8.4	<4	--
					25+	Soft sandstone	--	--	--
125	6	0-3%	San Arcacio	Sandy/loamy	0-3	SL, COSL	6.6-8.4	<8	Low
					3-14	SCL, SL	6.6-8.4	<2	--
					14-60	GRV-S, GR-SL, LCOS	7.4-8.4	<4	--
			Saguache	Loamy/sandy	0-6	SL, COSL, GR-SL	6.6-9.0	<2	Low
					6-60	GRV-S, COS, GRV-LS	6.6-9.0	<2	--
127	3	0-3%	Vermillion Variant	Shallow loamy	0-3	L	6.6-8.4	<2	Low
					3-8	CN-L, CN-CL	7.4-8.4	<4	--
					8-27	FLX-L, FLV-CL, FLV-L	7.9-8.4	<4	--
					27+	Hard mudstone	--	--	--
			Seedskadee	Shallow loamy	0-14	SCL, L, SL	7.0-8.5	<2	Low
					14+	Hard sandstone	--	--	--
			Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--

Table A-6.6 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
128	12	0-3%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--
			Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	Low
					1-19	SCL	6.6-7.8	<4	--
					19+	Shale-sandstone	--	--	--
			San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	Low
					4-14	SCL, SL	6.1-8.4	<2	--
					14-25	LCOS, COS, GRV-S	6.6-8.4	<4	--
					25+	Soft sandstone	--	--	--
951[2]/106	--	0-2%/see 106	Cowestglen	Overflow	0-3	CL	7.4-8.4	0	--
					3-8	CL	7.4-8.4	0	--
					8-60	CL	7.4-8.4	0	--

1 Adapted from ERO Resources Corporation (1988).
2 Criteria used to determine topsoil salvage depth: maximize loamy textures; minimize clayey textures, rock content, and salinity; salvage at least 6 inches if possible; salvage greater depths in better soils to a) provide a deeper seedbed and b) compensate for insufficient soils at other locations.
3 U.S. Department of Agriculture Texture.

C	Clay	FSL	Fine sandy loam	SCL	Sandy clay loam
CL	Clay loam			SIC	Silty clay
COS	Coarse sand	LCOS	Loamy coarse sand	SICL	Silty clay loam
COSL	Coarse sandy loam	LFS	Loamy fine sand	SIL	Silt loam
FS	Fine sand	L	Loam	SL	Sandy loam
FSCL	Fine Sandy clay loam	S	Sand	VFSL	Very fine sandy loam
		LS	Loamy sand		

Texture Modifier:

CN	Channery	GR	Gravelly
FLV	Very flaggy	GRV	Very gravelly
FLX	Extremely flaggy	SR	Stratified

Several associations (i.e., the Monte-Leckman, Fraddle-Tresano, Huguston-Horsely-Terada, Garsid-Monte, Kandaly-Terada-Huguston, and Baston-Boltus-Chrisman complexes/ associations) may be good sources for topsoil (see Tables A-6.5 and A-6.6). The Spool Variant-Ouard Variant-San Arcacio Variant, Fraddle-Ouard-Sand Arcacio Variant, and San Arcacio-Saguache complexes/associations may be good gravel sources (see Tables A-6.5 and A-6.6).

A-6.3 BIOLOGICAL CONSTRAINTS

Known sensitive biological resources present in the TPA include greater sage-grouse leks and nesting areas, raptor nests, pronghorn antelope migration corridors, and various habitats suitable for threatened, endangered, and other sensitive species. As with other environmental constraints, these resource locations and their associated buffers would be avoided, where practical, to minimize disturbance. In addition, inventories and monitoring of these resources would be conducted as specified in annual wildlife monitoring reports (TRC Mariah 2004). The locations of these resources are shown on maps available for review at area BLM offices.

A-6.4 OTHER ENVIRONMENTAL CONSTRAINTS

Numerous paleontologic and cultural resource sites are known to exist on the JIDPA. These sites would be avoided where possible during road improvement and construction activities. In addition, surveys for these resources would be conducted prior to construction, and monitoring of construction sites would be implemented as appropriate during development to avoid unnecessary disturbance.

Water developments (i.e., reservoirs, wells, and pipelines) occur throughout the area, and these locations are important for livestock and wildlife on the area. Roads developed and/or improvements for this project would avoid these locations, where possible, to minimize adverse effects to livestock and wildlife resources.

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A-7.0 ROAD SPECIFICATIONS, PLANS, AND MAINTENANCE

A-7.1 GENERAL REQUIREMENTS

In general, all new, improved, or rebuilt roads within the TPA would be developed according to the standards stated below for designed roads. Roads on state or private land within the area would be planned and built according to these same standards unless otherwise specified by the state or private landowner. Where roads are not developed in accordance with BLM standards, the potential for adverse impacts to health and safety and sensitive environmental resources is increased.

Newly designed roads on federal lands or those requiring a federal undertaking would comply with the requirements of the BLM District Engineer. The District Engineer requirements draw on the BLM Manual Section 9113 - Roads (BLM 1985) and the associated Wyoming State Supplement (BLM 1991), as well as other BLM manual sections. Design elements of the roads also would draw on the current American Association of State Highway and Transportation Officials (AASHTO), Manual on Uniform Traffic Control Devices (U.S. Department of Transportation Federal Highway Administration 1988), American Society for Testing Materials, and Wyoming State and Sublette County design criteria, where appropriate.

In March of 1992, the Wyoming BLM adopted the *Wyoming State Supplement to the BLM Manual 9113* (BLM 1991). This supplement amplifies several parts of the BLM Section 9113 (BLM 1985). Some of the information contained within this document is emphasized below:

> In Wyoming, BLM roads are designed, constructed, and/or upgraded for long-term use and are to be located, designed, and constructed to provide safety to the user and require the minimum amount of maintenance. Adequate design and construction of drainage structures, cut and fill slopes, and the travel-way will minimize future maintenance needs. The BLM will not accept roads constructed by others which require excessive maintenance expenditures by the BLM.

> A standard below the Resource Road classification may only be constructed for short duration use (30-60 days) and should not service traffic during the winter and spring months.
>
> In most cases, flat-bladed roads develop into canals and are a hazard to the user as well as creating environmental problems. Flat-bladed roads will not be authorized in Wyoming. The exception to this rule will be for the lowest class resource road where upgrading of short segments of an existing route is planned (i.e., excavating a hump for better site distance, widening a curve, etc).

Where information in the BLM manual dealing with roads and bridges seems inappropriate, the BLM PFO or RSFO Engineer would be consulted for clarification.

The following standards are the minimum standards for all roads constructed on BLM lands in Wyoming. The standards are found within BLM (1985). These standards are values established to ensure adequate uniformity and quality of all roads constructed on lands administered by the BLM. Average daily traffic, vehicle types, and design speed determine the geometric standards to be applied.

A-7.2 TECHNICAL REQUIREMENTS FOR ROADS

Because each road is unique, it is not the purpose of this document to give all of the technical data that may be necessary for every road. Each road construction project would be evaluated with its own requirements and appropriate technical information obtained during the transportation planning processes and subsequently processed APDs and ROW applications.

BLM Manual Section 9113 (BLM 1985) and its Wyoming State Supplement (BLM 1991) contain the comprehensive technical requirements necessary for the design of roads on Wyoming BLM lands. A copy of applicable BLM manual sections can be obtained from the BLM RSFO.

A-7.3 ROAD SURFACE MATERIAL

Road-surfacing material sources in the area are known from three locations--two sand pits and one gravel quarry. Potential surface material sources on and adjacent to the area are shown on the maps available for review at area BLM offices. The need for additional surface aggregate sources is not anticipated for this project.

Many roads within the TPA are or would be built across sandy or clayey soils and would require surfacing material. Both sandy and clayey soils are subject to special stability problems (see Section A-6.2), which can be remedied with the application of an aggregate surface. When surfacing aggregate is required for roads, it would consist of appropriate material and gradations. Surface material would be applied to the minimum compacted depths that meet current BLM standards.

Given the long-term traffic volumes associated with this project, the BLM may require the paving of selected primary access roads (e.g., Luman, Burma, Jonah North) and/or the use of magnesium chloride or other dust suppressants on more in-field collector, local, and resource roads.

A-7.4 DRAINAGE CROSSINGS

Bridge, culvert, and low-water crossing designs would conform to the BLM Manual Section 9112 (BLM 1990), Wyoming state law, and standard engineering practices. Drainage structures can be placed on most of the drainages within the TPA using a U.S. Army Corps of Engineers, Nationwide 404 Permit 14 (Road Crossings Sections 10 and 404). The U.S. Army Corps of Engineers would be consulted to obtain permits for crossing drainages, and it is anticipated that nationwide permit stipulations would be met under most circumstances. If the stipulations in Permit 14 cannot be met, a full standard 404 Permit would be required. The U.S. Army Corps of Engineers would be notified when construction of a road involves a drainage, even if all provisions of Permit 14 are met or flow in the drainage is intermittent. Usually, a simple letter to and a reply from the U.S. Army Corps of Engineers would satisfy the requirement on small drainages. If there is any question about the need to obtain a U.S. Army Corps of Engineers permit or the type of permit necessary, contact with the Wyoming U.S. Army Corps of Engineers would be initiated.

Culverts, bridges, or low-water crossings would be installed wherever a road is constructed across a defined drainage or natural channel. Culverts would be designed to pass no less than a 10-year flood without developing static head at the entrance, as identified by a BLM hydrologist, engineer, or other similarly qualified individual. Calculations would be based on local soil types and other pertinent environmental data. The size and gradient of the culvert would be designed to avoid damage from a 25-year flood. Culverts smaller than 18 inches in diameter would not be used due to problems with cleaning and maintenance.

In addition to installing culverts in defined drainages to provide adequate cross drainage and to minimize erosion, cross culverts would be installed at appropriate spacing for lateral drainage. There are three major factors to consider when determining culvert spacing--gradient, soil type, and rainfall intensity. Other factors that effect drainage are frost and frozen ground, snow depth, groundwater depth, soil permeability, and evaporation rate. Recommended spacing of cross culverts for various gradients and soil types are given in the BLM Manual Section 9113 (BLM 1985). This is a good guide for most situations and would be used unless local experience dictates otherwise.

In some relatively flat areas with permeable well-drained soils, a culvert may fill with sand and silt annually, providing no drainage. Culverts in areas with highly erosive soils have a tendency to wash out, leaving an impassable barrier. When past experience or soil and gradient conditions indicate potential problems with culverts, the best option may be to construct the road without cross-drain culverts except on defined drainages and to evaluate the drainage performance of the road and adjacent area. Raised roads with flat-bottomed ditches may be useful in poorly drained areas. If unacceptable amounts of water accumulate and do not dissipate within a reasonable period of time, corrective action would be taken. Such action may include installing a dip or low-water crossing or installing a culvert and evaluating its performance.

A-7.4.1 Culverts

Culverts are to be aligned with the natural drainage and would comply with BLM Manual Sections 9112 (BLM 1990) and 9113 (BLM 1985) and the Wyoming State Supplement (BLM 1991). Culverts would be installed as needed at all road intersections except when an intersection occurs at the crest of a ridge. The minimum allowable culvert diameter is 18 inches. Culverts and structures would be strong enough to support a minimum of HS-20 loading (AASHTO specification) as required by BLM (1985).

A-7.4.2 Low-water Crossings

Low-water crossings may be used with BLM approval, when necessary, as a type of drainage crossing where a 10-year runoff design produces more runoff than can be reasonably handled with a drainage structure or when the cost of a structure is unreasonable. Cost analysis, terrain and drainage features, structure stability, and necessary drainage diversions must be considered when determining the best alternative for crossing a drainage.

Environmental disturbance also must be considered. Drainage structures may not be the best environmental choice. Low-water crossings, if constructed properly, may cause less short- and long-term environmental damage than a large structure with road approach fills, water backup, and downstream bed scouring. Low-water crossings require continued maintenance to minimize erosion and to allow vehicles to cross. Low-water crossings should not be considered when there is a fishery or a water flow for more than just runoff periods. Low-water crossings in drainages with flow tend to become impassable during winter months due to the freeze and thaw cycles. Trucks attempting to cross ice crusts over water may break through and may high-center on the ice.

A-7.4.3 Bridges or Structures

Bridges and major culverts constructed on public lands must conform to standards as outlined in BLM Manual Section 9112 (BLM 1990), including design by or under the direction of a qualified registered professional engineer. These structures are special and would be developed site-specifically. Some structures, such as bridges, may need to be designed to carry heavier loads and would be considered individually at the time of construction. All bridges must have a minimum curb-to-curb or rail-to-rail width (whichever is less) of 14 ft for single-lane roads and 24 ft for double-lane roads but, in all cases, not less than the nominal width of the adjacent travelway as measured at right angles to the travelway centerline. All structures would be designed for a minimum of a HS-20 loading.

A-7.5 ROAD LAYOUT AND CONSTRUCTION INSPECTION

Surveying and staking necessary for road construction or improvement would be done by or under the direction of proper Wyoming registered professionals (e.g., surveyors, engineers). The complexity of the project would govern the amount of work, design, and inspection necessary.

A-7.5.1 Centerline Staking

Surveyors have many methods used to lay out roads. At a minimum, the BLM requires that stakes be placed on the centerline of the road at a maximum distance of 100 ft, at all fence or utility crossings, and at all abrupt breaks in ground profile of vertical change of 1 ft or more. Stakes would be placed on the centerline of the road at a maximum distance of 50 ft around curves of 4º or sharper. The station or stake number would be written clearly on each stake. Section corner ties would be made and shown on all road design plans, as presented in applications. The BLM may require additional construction staking criteria as determined on an individual basis.

A-7.5.2 Construction Monitoring

Many access roads can be constructed without major inspection efforts. Roads without unusual construction requirements may, in some cases, be monitored by Operators. The extent and type of construction monitoring would be determined by the BLM for roads across BLM land.

Construction inspection ensures the following.

- The route approved for construction is followed with as little environmental disturbance as practical.
- All sensitive environmental, paleontological, or cultural/historic sites are adequately protected.
- Construction methods properly remove organic matter from roadfill areas or fill material.
- Topsoil removal, stockpiling, and replacement and, in some instances, reseeding are conducted commensurate with approved design.
- Embankments meet proper width, slope, and compaction criteria. This may involve the use of water.
- Frost in the ground is not so excessive that it precludes proper construction.
- Reasonable efforts are made to walk equipment on the overall road surface to help with compaction.
- Drainage structure installation includes adequate compaction, rip-rap placement, drainage bowl installation, cover depths, wing ditch slopes and lengths, etc.
- Proper sign placement is used.

In some cases, the inspector may be required to certify that the construction was completed according the design parameters and standards specified in ROW applications. In this case, a Wyoming registered professional would provide to the BLM and relevant Operators a seal and signature on an affidavit of completion, according to the approved plans and specifications.

A-7.6 OTHER DESIGN GUIDELINES

The BLM Manual Section 9113 - Roads (BLM 1985) and its Wyoming Supplement (BLM 1991), as well as other applicable manual sections, would be the guides for design elements such as horizontal and vertical alignment, curve super elevation, cross-section elements, earthwork design, drainage elements, cattle guards, signs and markers, sight distances, and staking.

The roadway structure that includes the subgrade, the sub-base course (in some cases), and the base course (or the base course used as a surface course in the case of graded earth roads) must be strong enough to support HS-20 loadings (AASHTO specification) as required by BLM specifications or by engineer design where design exceeds BLM minimum requirements.

The special qualities of the particular road and its location govern how the structure is designed and built. In general, road surfacing varies in thickness according to various design factors.

All cattle guards or other structures are to have a minimum curb-to-curb or rail-to-rail width (whichever is less) of 16 ft for single-lane roads and 24 ft for double-lane roads but, in all cases, not less than the nominal width of the adjacent travelway as measured at right angles to the travelway centerline. All structures would be designed for a minimum of a HS-20 loading.

A-7.7 MAINTENANCE

All roads on the project area would be maintained to BLM 9113 Manual specifications (BLM 1985, 1991, and the latest edition of the Gold Book (*Surface Operating Standards for Oil and Gas Exploration and Development*). Maintenance on collector roads is anticipated to occur at least twice per year, whereas local and resource road maintenance may be required only once annually. All roads required for the project would be maintained as necessary to provide all-weather access (e.g., grading, surface material application, snow plowing), and Operators would be responsible for these maintenance actions. Maintenance agreements developed among Operators would be provided to the BLM (see Section A-8.0). Where roads become impassable, the BLM may deny access until the roads are repaired and/or the potential for resource damage is otherwise alleviated.

A-8.0 MAINTENANCE AGREEMENTS

Maintenance agreements are usually binding contracts between companies that deal with road maintenance. The BLM generally does not enter into maintenance agreements with companies. The preferred approach is for companies to work together and adjudicate maintenance agreements amongst themselves. Operators would provide the BLM with copies of all road maintenance agreements, including the name of a designated contact person. Non-project roads would be maintained by the BLM or other ROW holder.

Problems may occur with new Operators in an area. Maintenance agreements must be revised to include new users. If a company is the first to drill in an area, that company may be the sole road maintainer until other companies begin to access the area. Agreements would be reviewed and budgets for maintenance prepared where new Operators or users are identified. Meetings may be held with Operators and other road users to review maintenance agreements. If a company only has a few roads, review may be made over the phone with other participants and then the contract can be mailed and notarized signatures obtained. When Operators or other area users propose new activity that would utilize part or all of an existing road, maintenance agreements for existing roads must be restructured to include the new users.

Maintenance agreements would contain grading, surfacing, and other maintenance schedules, participant responsibilities, and cost allocation. Agreements would describe response methods and primary and secondary emergency contacts for hazard maintenance.

Operator responsibilities for road maintenance can be divided into at least three types of agreements. The principle maintenance agreement type weights the maintenance cost share of each Operator according to the amount of projected use of the road. The projected use can be based on past use, number of producing wells and facilities down-road, and wet weather access needs. The maintenance contract would have each Operator's tallied amounts and commitments for the upcoming year. This agreement type would be the most commonly used on the JIDPA. Other types of agreements involve Operators taking care of road maintenance on alternate time intervals or dividing a road into segments of near equal maintenance amounts and assigning each Operator maintenance responsibility for their segment of the road.

Snow removal often is considered as a separate item. Some Operators may not need access to sites during the winter months and may not participate in costs associated with snow removal. In some cases, roads may only need maintenance once or twice per year or at some other time interval.

A-9.0 LITERATURE CITED

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APPENDIX B:

RECLAMATION PLAN,
JONAH INFILL DRILLING PROJECT

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RECLAMATION PLAN, JONAH INFILL DRILLING PROJECT

Prepared for

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ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
EIS	Environmental impact statement
JIDPA	Jonah Infill Drilling Project Area
Operators	Natural gas developers
POD	Plan of Development
PLS	Pure Live Seed
RMP	Resource Management Plan
ROW	Right-of-way
SPCCP	Spill Prevention, Control, and Countermeasure Plan
SUP	Surface Use Plan
SWPPP	Storm Water Pollution Prevention Plan

B-1.0 INTRODUCTION

This reclamation plan will be used by natural gas developers (the Operators) of the Jonah Infill Drilling Natural Gas Development Project as guidance to achieve successful reclamation on federal lands within the Jonah Infill Drilling Project Area (JIDPA). Alternate reclamation procedures may be implemented on private and state lands or on federal lands as directed by the Bureau of Land Management (BLM). The plan complies with BLM reclamation and management directives specified in the Pinedale Field Office Resource Management Plan (RMP) (BLM 1987a, 1987b, 1988) and the Rock Springs Field Office RMP (BLM 1992, 1996, 1997). This reclamation plan is also based on *Executive Order* 13112, impacts and scoping issues identified for the Jonah Infill Drilling environmental impact statement (EIS) (see EIS Section 1.4), and an on-site evaluation of reclamation status on selected areas in the JIDPA.

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B-2.0 RECLAMATION REQUIREMENTS AND SUCCESS STANDARDS

B-2.1 RECLAMATION REQUIREMENTS

BLM's reclamation requirements include the following major goals.

- Isolate and/or remove all undesirable materials (e.g., contaminated soils, potentially hazardous materials) to protect the reclaimed landscape from contamination.
- Recontour the land surface and implement other soil conservation, surface manipulation, and water management techniques to establish stable slopes, water courses, and drainage features to minimize erosion and sedimentation (also protecting surface and ground water resources).
- Revegetate regraded areas to establish self-perpetuating native plant communities capable of supporting existing and future land uses.
- Minimize visual contrasts.

The reclamation success standards provided in Section B-2.2 are the measures that will show whether or not these goals are being met.

B-2.2 RECLAMATION SUCCESS STANDARDS

The following reclamation success standards are the measures that would be used to assess whether BLM's reclamation requirements are being met. The procedures presented below are designed to achieve the success standards and, in doing so, to meet BLM's requirements. Reclamation would be implemented, managed, and monitored by the Operators with BLM oversight/approval. Alternatives to all or portions of this reclamation plan may be implemented if the following standards would be met.

1) No contaminated materials would occur at or near the surface, and all buried undesirable materials would be encapsulated in impermeable material (e.g., sealed pit liners, concrete) and covered with at least 4 ft of spoil.

2) The subsurface would be stable--holes would be plugged and no indications of subsidence, slumping, and/or significant downward movement of surface soil materials would be visible.

3) Sites would be free of trash.

4) Reclaimed areas would be stable and would not exhibit evidence of active sheet flow, rills or gullies greater than 2 inches wide or deep or are actively eroding, perceptible soil movement or head cutting in drainages, and/or slope instability on or adjacent to the reclaimed area.

5) Soil surfaces would have adequate surface roughness to reduce runoff and to capture rainfall and snow melt.

6) Vegetative canopy cover, production, and species diversity of desirable species would approximate the surrounding undisturbed areas. Vegetation would help stabilize the site, would support post-disturbance land uses, and would be self-sustaining. Revegetated areas would exhibit vegetative reproduction, either spreading by rhizomatous species or seed production, and be free of noxious and non-native/invasive species; non-native species may be present only with BLM approval.

The following specific success standards for revegetation success (item 6 above) would be met. Unless otherwise indicated, these standards apply only to desirable species. Desirable species are generally considered those species present in the seed mix and/or perennial species present in the surrounding undisturbed landscape.

Within 1 to 2 years after seeding, the following standards would be met (in addition to standards 1-6).

a) Vegetative canopy cover would be at least 35% of the cover found on adjacent undisturbed areas.

b) At least 20% of the total vegetation cover would be by the species contained in the seed mix and/or present on adjacent areas.

c) Invasive, non-native species (weeds) or other undesirable species would not dominate the reclaimed area.

Within 4 years after seeding, the following standards would be met (in addition to standards 1-6).

d) Vegetative canopy cover would be at least 60% of the cover found on adjacent undisturbed areas.

e) At least 50% of total vegetation cover would be by the species contained in the seed mix and/or present on adjacent undisturbed areas, and no single species would account for more than 50% of total vegetative cover unless it comprises greater than 50% of the total vegetative cover on adjacent undisturbed areas.

f) Invasive, non-native species or other undesirable species (e.g., weeds) would comprise no more than 15% of total vegetative cover.

Within 10 years after seeding, the following standards would be met.

g) Vegetative canopy cover would be at least 80% of the cover found on adjacent undisturbed areas.

h) At least 90% of the species present on revegetated areas would be species from the seed mixture, from the surrounding native vegetation, and/or other desirable species, and no single species would make up more than 25% of the total vegetative cover unless it comprises greater than 25% of the total vegetative cover on adjacent undisturbed sites.

i) Undesirable species (e.g., noxious, non-native, or invasive species) would make up less than 5% of total vegetative cover.

7) The reclaimed landscape would have characteristics that approximate the visual quality of adjacent areas with regard to location, scale (e.g., line, form, and

texture), contour, color, and orientation of major landscape features and would support post-disturbance land uses.

Permanent revegetation would be considered successful when standards 1-5, 6g, 6h, 6i, and 7 have been achieved.

B-3.0 AFFECTED COMMUNITIES

As described in Section 3.2.1 of the EIS, the JIDPA is dominated by the Wyoming big sagebrush/grassland vegetation type. Saltbush, cushionplant, and basin big sagebrush communities also are present to a limited extent, primarily in the eastern portions of the JIDPA and along Sand Draw.

Potential wetlands occupy approximately 47 acres of the JIDPA (less than 0.1% of the area) and occur as inclusions within the dominant vegetation types. One of these potential wetlands is a large playa (23 acres) occurring on private surface in Section 32, T29N, R108W.

One area with stabilized sand dunes occurs in the JIDPA in Sections 2 and 11, T28N, R108W (see Map 3.2 in the EIS).

Reclamation potential within the sagebrush, grassland, and potential wetland communities is good to excellent. In the saltbush, cushionplant, and playa communities, reclamation success would be limited by shallow soils, droughtiness, salinity, and other adverse soil characteristics. Reclamation potential also may be limited by other extant conditions on the JIDPA, including sandy soils (dunal areas), steep slopes, noncohesive soils, weather conditions (high winds, drought), short growing seasons, and livestock and wildlife use.

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B-4.0 RECLAMATION PLAN

The reclamation process will consist of the following steps (Figure B-4.1).

- predisturbance planning and site preparation,
- some temporary reclamation,
- permanent reclamation, and
- reclamation success monitoring.

B-4.1 PREDISTURBANCE PLANNING AND SITE PREPARATION

Predisturbance planning minimizes the amount of reclamation at a site by reducing land disturbance. In addition, preparing the site for construction while planning for reclamation (e.g., salvaging and stockpiling topsoil and spoil, separately; locating facilities away from cut-and-fill slopes; minimizing the area occupied by facilities) would facilitate achieving reclamation success.

B-4.1.1 Predisturbance Planning

During selection of drill site, road, pipeline, and ancillary facility locations, Operators would avoid the following areas, where practical:

- areas with high erosion potential (e.g., rugged topography, steep slopes [>25%], stabilized sand dunes, floodplains);
- areas with saturated soils;
- areas within 500 ft of wetland or riparian areas (e.g., playas and open water areas); and
- areas within 100 ft of ephemeral and intermittent channels.

Prior to disturbance, Operators would conduct on-site inspections with the BLM or other surface owner of each proposed disturbance area to determine the suitability of proposed facility locations and/or corridors with regard to the above-listed avoidance areas. In addition, Operators would submit for BLM approval Surface Use Plans and/or Plans of Development for each

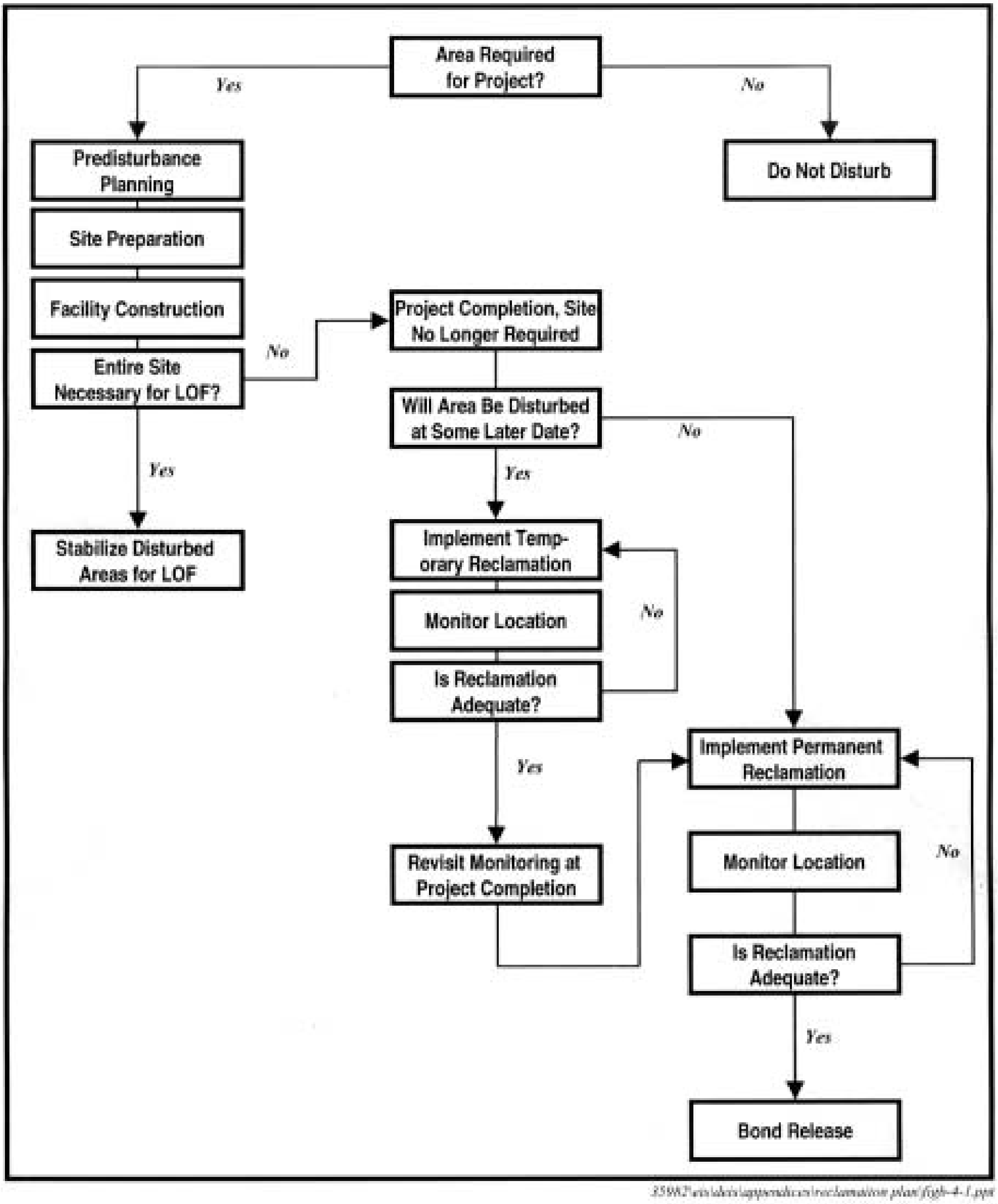

Figure B-4.1 Reclamation Process, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

proposed surface disturbance area or corridor. These plans would include the following components:

- project administration, time frames, and responsible individuals;
- a commitment to adhere to this reclamation plan;
- detailed descriptions of all deviations from this plan required due to site-specific conditions and the rationale for changes; and
- a commitment to meet the reclamation success standards described above.

In addition to Surface Use Plans and Plans of Development, Storm Water Pollution Prevention Plans (SWPPPs) would be prepared for all project activities requiring greater than 5 acres of disturbance to ensure that storm water runoff would not cause surface water pollution. The SWPPP would include provisions for periodic inspection of storm water pollution prevention devices and practices. A Notice of Intent would be submitted to the Wyoming Department of Environmental Quality. Copies of the SWPPP and inspection reports would be filed in Operator offices.

B-4.1.2 Site Preparation

B-4.1.2.1 Trash and Spills

Trash removal would occur routinely throughout field development and operation. Trash would be picked up by field personnel and disposed of at on-site trash receptacles. These receptacles would be serviced by a licensed solid waste contractor.

Spills would be handled in accordance with Operator-specific Spill Prevention, Control, and Countermeasure Plans (SPCCPs) for the field.

Because trash and spilled materials would be routinely disposed of, removal of these materials is included in the operation plan rather than in the reclamation plan. However, topsoil would not be placed on contaminated materials, and the absence of contaminated materials at or near the ground surface is a reclamation requirement and a reclamation success criterion.

B-4.1.2.2 Topsoil and Spoil Handling

Topsoil would be salvaged from all proposed disturbance areas and stockpiled, unless the BLM deems that leaving topsoil in place would facilitate better reclamation. Vegetation would be salvaged and stockpiled with topsoil to incorporate native seeds and organic matter.

Addendum B-A provides a table of typical soil salvage depths for the various soil types occurring within the JIDPA. At each location to be disturbed, Operators would use the soils map and soil salvage depths table to determine appropriate surface soil material salvage depths. Alternatively, a qualified soil scientist or reclamation specialist may make a field-based determination on appropriate salvage depth(s). This may require soil testing to determine fertility and overall suitability of materials as a plant growth medium. Soil and spoil testing would be required (see Section B-4.4.3) if the Year 4 reclamation success standards (see Section B-2.2) are not met. The volume of topsoil or other suitable plant growth material to be salvaged, proposed topsoil replacement depth, and topsoil storage areas would be specified in the SUP or POD. If less than 6 inches of topsoil are available, topsoil could be mixed with suitable spoil, with BLM approval, so that a minimum of 6 inches of plant growth material is available for use during reclamation. Spoil to be mixed with topsoil would be tested, and amendments would be added so that it meets fair and above suitability criteria for topsoil (Table B-4.1). No unsuitable materials would be used. Alternatively, Operators would identify other topsoil stockpile(s) from which topsoil would be obtained for reclamation. For example, if Location A has less than 6 inches of topsoil but 24 inches were salvaged from neighboring Location B, Operators may identify the neighboring location as the source of additional surface soil material. The SUP or POD for both locations would note that a specific volume of topsoil from Location B is slated for use at Location A.

Table B-4.1 Criteria to Establish Suitability as Topsoil (or Topsoil Substitutes).[1]

Parameter	Suitability: Good	Suitability: Fair	Suitability: Poor	Unsuitable
pH	6.0-8.4	5.5-6.0 8.4-8.8	5.0-5.5 8.8-9.0	<5.0 >9.0
EC (conductivity) mmhos/cm	0-4	4-8	8-16[2]	>16[2]
Saturation Percentage	25-80		>80 <25	--
Texture[3]	SL, L, SIL, SCL, VFSL, FSL	CL, SICL, SC, LS, LFS	C, SIC, S	--
SAR	<6	6-10	10-15 10-12[4]	>15 >12[4]
Selenium	<2.0 ppm			>2.0 ppm
Boron	<5.0 ppm			>5.0 ppm
Calcium Carbonate	0-15%	15-30%	>30%	--
Coarse Frag. (% volume)				
3-10 inches	0-15	15-25	25-35	>35
>10 inches	0-3	3-7	7-10	>10
Consistency[5]				
Moist	VFR, FR	LO, FI	VFI, EXFI	--
Dry	LO, SO	SH, H	VH	

1 Adapted from Wyoming Department of Environmental Quality Land Quality Division (1981).

2 EC (conductivity) of >8 may prove difficult to revegetate.

3 Soil Conservation Service:

C	=	Clay	SC	=	Sandy Clay
CL	=	Clay loam	SCL	=	Sandy clay loam
FSL	=	Fine sandy loam	SIC	=	Silty clay
L	=	Loam	SICL	=	Silty clay loam
LFS	=	Loamy fine sand	SIL	=	Silt loam
LS	=	Loamy sand	SL	=	Sandy loam
S	=	Sand	VFSL	=	Very fine sandy loam

4 For fine-textured soils (clay >40%) (Gee et al. 1978).

5 Consistency:

EXFI	=	Extremely firm	SH	=	Semi-hard
FI	=	Firm	SO	=	Soft
FR	=	Friable	VFI	=	Very firm
H	=	Hard	VFR	=	Very friable
LO	=	Loose	VH	=	Very hard

Where cut-and-fill construction is required, Operators would, to the extent possible, balance the volumes of cut versus fill material to minimize the volume of spoil stockpiled. Spoil would be salvaged and stockpiled separately from topsoil.

For pipelines and access roads constructed on slopes of less than 15%, topsoil would be salvaged from all areas to be disturbed and stockpiled in windrows within the construction right-of-way (ROW) by sidecasting with a grader. Where pipelines and roads are to be constructed on slopes greater than 15%, topsoil would be transported to more level terrain for storage.

Topsoil and spoil stockpiles would be constructed to remain stable until they are used for reclamation. Whenever possible, topsoil would be used immediately. If topsoil would be stockpiled for more than 2 years, than the piles would be reduced to 3 ft in height and seeded. Stockpile slopes will be 5:1 or less. If a topsoil stockpile is located on or adjacent to ground that slopes 3:1 or more, runoff would be diverted around the stockpile via interceptor ditches. Interceptor ditches would be V-shaped--1 ft deep and 3 ft wide with gently sloping sides--and would empty onto native, undisturbed vegetation. Alternatively, energy dispersing devices (e.g., rock aprons) would be placed at each end of the interceptor ditch. All stockpiles will be located so as not to affect existing drainages. Temporary reclamation (see Section B-4.3) would be implemented immediately on all topsoil and spoil stockpiles.

Topsoil and spoil stockpiles would be clearly marked and noted on site maps and may be identified with signs.

B-4.1.2.3 Additional Procedures for Wetlands

Well pads would not be located in wetlands. Where roads and pipelines must cross wetlands, construction would occur when the area is dry, if possible. In work areas that would not be excavated but would be driven on (e.g., scalped pipeline corridors adjacent to pipeline trenches), vegetation would be cut to ground level, leaving existing root systems intact; these areas would not be graded. At least 12 inches of topsoil would be salvaged and replaced from wetland areas except in areas with standing water or saturated soils, where no topsoil would be salvaged. If standing water or saturated soils are present, either wide-track/balloon-tire construction equipment or typical construction equipment operated on equipment pads would be used. Equipment pads would be removed immediately upon completion of construction.

B-4.2 RECLAMATION TIMING

Temporary and permanent reclamation would occur in the first fall (September 15 to freeze-up) or spring (prior to May 15 and only if fall seeding is not feasible) following completion of required activities (e.g., road or pipeline construction, reserve pit fluid evaporation).

B-4.3 TEMPORARY RECLAMATION

The objectives of temporary reclamation are to meet success standards 1-6 above (see Section B-2.2). Additionally, vegetation on temporary reclamation would help stabilize soils.

Temporary reclamation would be conducted on areas that would be redisturbed (e.g., topsoil and spoil stockpiles) prior to project abandonment. For operating well pad cut-and-fill slopes, Operators may elect to conduct either temporary or permanent reclamation. Temporary reclamation would not be used as a means to delay permanent reclamation on areas that would not be redisturbed.

Temporary reclamation areas would be graded and contoured to slopes of 3:1 or less. Topsoil and spoil stockpiles would be constructed with side slopes of 5:1 or less. Graded surfaces would be ripped, if necessary, to eliminate soil compaction. Surfaces would then be disced to loosen surface material.

Topsoil would not be replaced on all temporary reclamation areas for the following reasons. First, much of the temporary reclamation would occur on topsoil stockpiles. Second, topsoil should not be mixed with spoil (except as described in Section B-4.1.2.2), so placing topsoil on spoil stockpiles would not occur. Finally, replacing and then re-disturbing topsoil on temporary reclamation areas would increase the potential for topsoil loss while it is being handled, stockpiled, and replaced a second time; topsoil handling would be minimized.

After discing, the area would be seeded using the seed mixture for temporary reclamation (Table B-4.2) or one of the seed mixtures for permanent reclamation (see Tables B-4.3 through

Table B-4.2 Seed Mixture for Temporary Reclamation.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Western wheatgrass (*Elymus smithii*)	2.0
Slender wheatgrass (*Elymus trachycaulus*)	2.0
Streambank wheatgrass (*Elymus lanceolatus* var. *riparius*)	2.0
Winter wheat (*Triticum aestivum*)[3]	10.0
Total	16.0

[1] It is anticipated that this seed mixture primarily would be used on topsoil and subsoil stockpiles designated for long-term storage.

[2] PLS/acre = pounds of pure live seed per acre; alternate seeding rates may be applied in some areas as deemed appropriately by BLM and specified in approved SUPs and/or PODs.

[3] A sterile hybrid would be seeded as a cover crop; cover crops would be used only in areas where rapid site stabilization is desired and where further disturbance and reseeding efforts likely would be conducted.

B-4.7 below). Operators would determine which mixture to use based on seed availability, cost, or other operational considerations.

Operators may elect to plant a cover crop of winter wheat or other sterile hybrid and then interseed with the other three species in the mixture for temporary reclamation or with a mixture for permanent reclamation. Cover crops provide rapid site stabilization and protect surfaces from wind and water erosion, and plant root structures improve soil permeability.

B-4.4 PERMANENT RECLAMATION

Permanent reclamation would be conducted on all disturbed areas no longer required for field operations (e.g., portions or all of well pads, road outslopes, and pipeline corridors). Permanent reclamation would be conducted on pads and roads for non-producing wells and on pads for wells that have reached the end of their productive life (includes facility removal and complete well pad and access road reclamation). Because permanent reclamation would occur throughout the LOP, this plan does not differentiate between "interim" and "final" reclamation. All permanent reclamation is considered final unless monitoring shows that it needs to be repeated.

Operators would completely reclaim all portions of well pads not required for operations, access road out-slopes, and pipeline corridors in the fall or spring immediately following construction or dry hole abandonment. Reserve pits would be completely reclaimed in the first fall or spring after drying. If reclamation involves facility removal (Section B-4.4.1), regrading and reseeding would occur in the first fall or spring following facility removal.

B-4.4.1 Facility Removal

Some facilities would reach the end of their operational life during the LOP, whereas others would remain in use until field production is complete. When the Operators determine that a well or other facility is no longer needed, it would be removed and the area would be permanently reclaimed.

All gas wells and generally all water wells would be abandoned according to BLM and/or Wyoming Oil and Gas Conservation Commission regulations. Some water wells may be retained for other uses after the LOP. Aboveground wellpad, pipeline, and water disposal facilities, including buildings, tanks, flare pits, reserve pits, evaporation pits, and associated hardware, would be dismantled, removed from BLM lands, and salvaged and re-used or disposed of at approved sites. Underground pipelines would be purged of gas or liquid, plugged, and abandoned in place.

Liquid or solid wastes remaining at well locations would be tested and properly disposed of according to state and federal regulations. Reserve and evaporation pit liners would be disposed of at state-approved sites or buried on-site. Concrete foundations, pads, or footings would be broken-up and removed or buried on-site. Aggregate used for wellpad, road, and other facility construction also would be removed or buried on-site. Operators would obtain BLM approval for all on-site burial proposals.

Road reclamation would include the removal of bridges, culverts, cattleguards, sediment control structures, and signs. Drainage-crossing sideslopes would be reduced to no more than 4:1 to reduce bank erosion and produce stable sideslopes. Barriers would be used to discourage travel on the reclaimed roads and pipelines until permanent reclamation is deemed successful.

B-4.4.2 Surface Preparation

B-4.4.2.1 Backfilling and Grading

Backfilling would occur prior to grading. Areas to be backfilled include flare pits, reserve pits, cut slopes, pipeline trenches, borrow ditches, and facility foundations. Pipeline trenches would be backfilled so that the soil berm is less than 3 inches high. Spoil for backfill would be obtained from fill material and spoil stockpiles.

Areas to be reclaimed would be graded to approximate original contours and to blend in with adjacent topography. Area-wide drainage would be restored so that surface runoff flows and gradients are returned to the conditions present prior to development. Graded surfaces would be suitable for the replacement of a uniform depth of topsoil, would promote cohesion between subsoil and topsoil layers, would reduce wind erosion, and would facilitate moisture capture.

Specialized grading techniques would be applied at the Operators' discretion and may include slope rounding, bench grading, stair-step grading, and/or contour furrowing.

Dozers, loaders, scrapers, and motor graders are typically used for backfilling and grading.

B-4.4.2.2 Ripping and Discing

Compacted areas such as roads and wellpads would be ripped to a depth of approximately 2 ft to improve soil aeration, water infiltration, and root penetration. Ripped areas would be disced, if necessary, to fill-in deep furrows (where topsoil would be lost) and break-up large clods (to which topsoil would not adhere).

Motor graders or tractors equipped with ripping shanks are typically used for ripping. Ripper shanks would be set approximately 1 to 2 ft apart. Discing is typically accomplished using a tractor-drawn disc set 2-6 inches deep.

B-4.4.3 Seedbed Preparation

Seedbed preparation maximizes seeding efficiency and improves reclamation success. It includes topsoil replacement (with amendments, where appropriate) and discing. Surface roughening procedures (e.g., pitting, gouging) also may be applied at the discretion of Operators.

B-4.4.3.1 Topsoil Replacement

Waterbars and erosion control devices would be installed on reclaimed areas prior to topsoil replacement, as necessary, to control topsoil erosion (see Section B-4.5.2).

Between 6 and 24 inches of stockpiled topsoil would be redistributed uniformly on areas to be reclaimed. If the stockpile for a given location contains insufficient topsoil to meet the required 6-inch minimum, topsoil would be mixed with suitable spoil or imported from another location as described in Section B-4.1.2.2. Topsoil would not be replaced on contaminated material--all contaminated material would be removed or otherwise handled in accordance with the SPCCPs.

Topsoil is typically replaced using scrapers, dozers, and/or motorgraders.

Once topsoil is replaced, seeding would occur within 2 weeks unless the ground is wet or frozen. In this circumstance, seeding would be delayed until the ground dries or thaws to the point where soils are friable. An early frost would not be used to delay seeding until the following spring if subsequent fall conditions are appropriate for seeding.

Operators have the discretion to conduct soil fertility tests and/or use fertilizers; it is not required for the first attempt at permanent reclamation because fertilizers generally are not effective in semi-arid climates. Fertilizers would not be used near open water. In addition to fertilizer use, Operators have the discretion to use other amendments such as inoculation with soil microorganisms, lime, organic matter, etc.

If Year-4 reclamation success standards are not met, soil tests would be implemented to determine the need for fertilizers or other soil amendments.

B-4.4.3.2 Discing

After topsoil replacement, newly topsoiled areas would be disced or harrowed to reduce soil compaction, to break up soil clods, to improve root and water penetration, and to provide a friable but firm seedbed. The surface would be rough to reduce wind and water erosion and to promote moisture capture.

If the surface is roughened during discing, other moisture-capture techniques are probably not needed. However, Operators have the full discretion to implement techniques such as pitting and gouging to concentrate water in pits and gouges. If Year-4 reclamation success standards are not met, BLM may require implementation of these kinds of techniques.

Discing and harrowing are typically accomplished using a tractor-drawn disc or harrow set 2-6 inches deep.

B-4.4.4 Revegetation

B-4.4.4.1 Seeding

Reclaimed areas would be seeded using the seed mixtures presented in Tables B-4.3 through B-4.7. These mixtures were developed based on the following criteria: general conditions within the analysis area, species adaptations to site conditions, usefulness of the species for rapid site stabilization, species success in past revegetation efforts, seed costs and availability, and compliance with *Executive Order* 11987 and BLM Manual Section 1745 (i.e., use of native species).

Alternative species and seeding rates may be used at Operator discretion, if warranted by site-specific conditions or seed availability, provided that the alternative species/seeding rates facilitate achieving reclamation success and all modifications are documented as described in Section B-2.2.

Seed mixtures would be certified weed-free.

Table B-4.3 Suggested Permanent Reclamation Seed Mixture for Sagebrush-dominated Communities with Sandy Soils.[1]

Species	Drill Seeding Rate (PLS/acre)[2]
Grasses	
Thickspike wheatgrass (*Elymus lanceolatus* var. *lanceolatus*)	2.00
Western wheatgrass (*Elymus smithii*)	2.00
Bluebunch wheatgrass (*Elymus spicatum*)	2.00
Indian ricegrass (*Oryzopsis hymenoides*)	3.00
Needle-and-thread (*Stipa comata*)	3.00
Forbs (select one or more of the following forb species)	
Desert Indian paintbrush (*Castilleja chromosa*)	1.00
Scarlet globemallow (*Sphaeralcea coccinea*)	1.00
Shrubs (select 2 or more of the following shrub species)	
Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	0.25
Common winterfat (*Krascheninnikovia lanata*)[3]	1.00
Four-wing saltbush (*Atriplex canescens*)	3.00
Antelope bitterbrush (*Purshia tridentata*)	1.00

1 Operators may submit for approval alternative site-specific seed mixtures.
2 PLS/acre = pounds of pure live seed per acre. Seeding rates would be doubled if seed is to be broadcast.
3 Winterfat seed would be broadcast simultaneously with drill-seeding other species.

Table B-4.4 Suggested Permanent Reclamation Seed Mixture for Sagebrush-dominated Communities with Alkaline Soils.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Western wheatgrass (*Elymus smithii*)	3.00
Thickspike wheatgrass (*Elymus lanceolatus* var. *lanceolatus*)	3.00
Alkaligrass (*Puccinellia distans*)	3.00
Alkali sacaton (*Sporobolus airoides*)	3.00
Forbs (select one or more of the following forb species)	
Scarlet globemallow (*Sphaeralcea coccinea*)	1.00
Evening primrose (*Oenothera* sp.)	1.00
Shrubs (select two or more of the following shrub species)	
Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	0.25
Common winterfat (*Krascheninnikovia lanata*)[3]	1.00
Four-wing saltbush (*Atriplex canescens*)	3.00
Gardner saltbush (*Atriplex gardneri*)	1.00

1 Operators may submit for approval alternative site-specific seed mixtures.
2 PLS/acre = pounds of pure live seed per acre. Seeding rates would be doubled if seed is to be broadcast.
3 Winterfat seed would be broadcast simultaneously with drill-seeding other species.

Table B-4.5 Suggested Permanent Reclamation Seed Mixture for Saltbush Communities.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Sandberg bluegrass (*Poa sandbergii*)	1.0
Western wheatgrass (*Elymus smithii*)	2.0
Thickspike wheatgrass (*Elymus lanceolatus* var. *lanceolatus*)	2.0
Alkaligrass (*Puccinellia distans*)	3.0
Alkali sacaton (*Sporobolus airoides*)	3.0
Forbs (select one or more of the following forb species)	
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	1.0
Northern sweetvetch (*Hedysarum boreale*)	1.0
Evening primrose (*Oenothera* sp.)	1.0
Shrubs (select two or more of the following shrub species)	
Four-wing saltbush (*Atriplex canescens*)	3.0
Shadscale (*Atriplex confertifolia*)	1.0
Gardner saltbush (*Atriplex gardneri*)	1.0
Common winterfat (*Krascheninnikovia lanata*) [3]	1.0

1 Operators may submit for approval alternative site-specific seed mixtures.
2 PLS/acre = pounds of pure live seed per acre. Seeding rates would be doubled if seed is to be broadcast.
3 Winterfat seed would be broadcast simultaneously with drill-seeding other species.

Table B-4.6 Suggested Permanent Reclamation Seed Mixture for Playas and Other Alkaline Areas.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Muhly (*Muhlenbergia* spp.)	2.0
Alkaligrass (*Puccinellia distans*)	3.0
Alkali sacaton (*Sporobolus airoides*)	3.0
Western wheatgrass (*Elymus smithii*)	3.0
Forbs (select one or more of the following forb species)	
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	1.0
Northern sweetvetch (*Hedysarum boreale*)	2.0
Shrubs	
Four-wing saltbush (*Atriplex canescens*)	3.0
Gardner saltbush (*Atriplex gardneri*)	1.0

1 Operators may submit for approval alternative site-specific seed mixtures.
2 PLS/acre = pounds of pure live seed per acre. Seeding rates would be doubled if seed is to be broadcast.

Table B-4.7 Suggested Permanent Reclamation Seed Mixture for Stabilized Sand Dune Communities.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Prairie sandreed (*Calamovilfa longifolia*)	3.00
Bluebunch wheatgrass (*Elymus spicatum*)	2.00
Sand dropseed (*Sporobolus cryptandrus*)	2.00
Indian ricegrass (*Oryzopsis hymenoides*)	2.00
Needle-and-thread (*Stipa comata*)	2.00
Basin wildrye (*Elymus cinerus*)	1.00
Forbs (select one or more of the following forb species)	
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	1.00
Desert Indian paintbrush (*Castilleja chromosa*)	1.00
Northern sweetvetch (*Hedysarum boreale*)	1.00
Shrubs	
Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	0.25
Spiny hopsage (*Grayia spinosa*)	1.00

[1] Operators may submit for approval alternative site-specific seed mixtures.
[2] PLS/acre = pounds of pure live seed per acre. Seeding rates would be doubled if seed is to be broadcast.

Operators would determine which seed mixture to use and which substitute species may be appropriate to include in the mixture either in consultation with BLM. Operators may also elect to use interseeding techniques (BLM may require this if Year-4 reclamation is not successful).

Operators have the discretion to inoculate selected seed mixtures with soil microorganisms to facilitate germination and growth. If Year-4 reclamation success standards are not met, BLM may require seed mixture inoculation.

Seeding would be conducted in the fall between September 15 and freeze-up. If fall seeding is not feasible, seeding may occur between spring thaw and May 15. Seeds would be planted along contour using a rangeland drill equipped with an agitator and depth bands to mix seed and ensure proper seeding depths. Seeds would be planted 0.25 to 0.50 inch deep. Fluffy seeds (e.g., winterfat) would be broadcast simultaneously with drilled seeding. Broadcast seeding may be used, at the Operators' discretion, for other shrub and forb species, utilizing either hand or specialized broadcast seeders.

When drill-seeding is not practical due to steep slopes, rocky surfaces, or wet soil conditions, seeding rates would be doubled, seeds would be broadcast, and the area would be raked or chained to cover seeds. Operators may elect to broadcast seed after applying and crimping 2 tons/acre of certified weed-free mulch.

Operators may elect to hand-plant bare-root or containerized shrub stock to facilitate shrub establishment. It is not required for the first-time attempt at permanent reclamation but may be required at a later date by BLM if reclamation success is not achieved.

B-4.4.4.2 Mulching

Where mulching is deemed necessary, the reclaimed area would be uniformly mulched (75% minimum cover) with certified weed-free native grass, hay, small grain straw, wood fiber, and/or live mulch, at a rate of 2 tons/acre. Alternatively, cotton, jute, or synthetic netting would be applied. Mulch would be crimped into the soil, tackified, or incorporated into erosion control blankets to prevent it from blowing or washing away and from entering waterways. Mulch would protect the soil from wind and water erosion, raindrop impact, and surface runoff and would help hold seeds in place. Mulching may occur prior to or after broadcast seeding but must occur after drill seeding.

On steep slopes where it is unsafe to operate equipment, at sites where soils have 35% or more surface rock content, or on notably unstable areas, hydromulch, biodegradable erosion control netting, or matting would be firmly attached to the soil surface.

B-4.5 EROSION CONTROL

B-4.5.1 Construction- and Operation-Phase Erosion Control

Chapter 2.0 in the EIS provides construction procedures, and erosion control practices have been designed into these procedures. Operators would also adhere to the following additional erosion control measures during construction and operation.

Standard culverts, road ditches, and road design would be used in accordance with typical engineering practices to minimize erosion along active roads. Culverts would be sized to pass expected flows without causing erosion above, below, or around the culvert. Culvert entrances and exits would be protected with energy dissipaters such as riprap or rock aprons as necessary. Road ditches would be sized to collect runoff from roads and surrounding areas; energy dissipating structures such as straw bales anchored with rebar would be used to prevent ditch erosion. Roads would be designed to enable head-on traffic to pass without leaving the surfaced travelway. If turnouts are used for this purpose, Operators would instruct field personnel to use turnouts to avoid traveling on roadside ditches. Water discharged from culverts, roadside ditches, and turnouts would be directed either into undisturbed vegetation or natural drainages.

Interceptor ditches would be installed above all cut slopes. Interceptor ditches would be V-shaped--1 ft deep and 3 ft wide with gently sloping sides--and would empty onto native, undisturbed vegetation. Alternatively, energy-dispersing devices (e.g., rock aprons) would be placed at each end of the interceptor ditch.

Sediment control devices would be placed at the base of all fill slopes and stockpiles.

Where road or pipeline construction occurs on slopes of 3:1 or more, temporary sediment barriers such as silt fences and/or staked weed-free straw bales would be installed along contour below the road/pipeline corridor. Silt fences or other sediment filtering devices would also be installed wherever road or pipeline construction occurs within 100 ft of a drainage or wetland. Temporary sediment barriers would remain in place until the surfaces are stable and reclamation success standards are met (see Section B-2.2). Sediment filtering devices would be cleaned out and maintained in functional condition throughout the LOP.

Trench plugs would be used during pipeline construction at nonflumed drainage crossings to prevent diversion of flows into upland portions of pipeline trenches. Instream protection devices (e.g., drop structures) also may be used to prevent erosion in drainages crossed by pipelines. In drainages, clean gravel would be used for the upper 1 ft of backfill in pipeline trenches. Application of riprap to channel banks would be limited to areas where flow conditions prevent stabilization by vegetation. Riprap installation would comply with U.S. Army Corps of

Engineers' permit requirements. Pipeline trenches would be dewatered so no construction-related silty water flows into drainage channels.

Where roads and pipelines cross a waterbody (i.e., wetlands or drainages), topsoil and spoil would be placed at least 10 ft from the edge of the waterbody, and sediment control structures would be placed between the topsoil/spoil and the waterbody. Dirt, rock, and brush riprap would not be used to stabilize the ROWs at waterbody crossings.

B-4.5.2 Reclamation-phase Erosion Control

All reclaimed surfaces would be left rough and would be mulched, if recommended by the BLM, as described in Section B-4.4.4.2, to reduce wind and water erosion. Erosion and sediment control structures would be installed on reclaimed areas wherever slope gradients exceed 3:1 and where monitoring demonstrates that erosion control structures are needed.

Runoff from reclaimed areas where slopes exceed 3:1 (and where monitoring suggests that it is warranted) would be controlled using standard structures including, but not necessarily limited to, waterbars, silt fences, geotextile, and energy dissipaters. Areas with concentrated development with closely spaced pads (more than 1/40 acres) would be subject to reclamation efforts that address cumulative runoff, regardless of slope. Waterbars would be installed in accordance with standard BLM specifications and would drain into undisturbed vegetation. Waterbars generally will be 12-18 inches in height with a 2% grade. Waterbars would be installed after ripping and prior to topsoil placement. Silt fences would be placed downhill from reclaimed areas where erosion may impact a waterbody and would be installed according to manufacturers' instructions. Energy dissipaters would be used wherever water is channelized (e.g., by a waterbar or an interceptor ditch) to slow flows.

All runoff and erosion control structures would be inspected, maintained, and cleaned-out by Operators on a regular basis throughout the LOP. Inspections would occur after runoff events (e.g., spring runoff, storm events). Sites and sources of soil movement would be addressed in a timely manner and recorded in a way that would allow for erosion pattern tracking. These reports would be provided to BLM annually.

B-4.6 WEED CONTROL

Operators would be responsible for noxious, non-native, and invasive weed control from all project activities for the LOP. If use of herbicides is deemed necessary by Operators or BLM, a Pesticide Use Permit would need to be submitted for approval to the BLM. All herbicides would be used only in the season or growth stage during which they are most effective. Herbicides would be applied only by certified personnel using approved precautions and application procedures in compliance with all applicable federal, state, and local regulations. Herbicides would not be used within 100 ft of open water or during extremely windy conditions. Aerial application of herbicides would be prohibited within 0.25 mi of known special status plant species locations (i.e., federally listed or BLM-sensitive species) and hand application of herbicides would not occur within 500 ft of such occurrences. Certified weed-free seed mixtures and mulches would be used, thereby minimizing the potential for noxious weed introduction.

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B-5.0 RECLAMATION SUCCESS MONITORING

This monitoring plan was developed with two primary objectives: 1) to document the condition of reclaimed areas relative to the revegetation success criteria provided in Section B-2.2 and 2) to provide an expeditious means for monitoring all reclamation sites to document reclamation progress.

B-5.1 MONITORING RESPONSIBILITIES

Operators would be responsible for the following:

- monitoring,
- determining if reclamation success standards are being met,
- developing and implementing remedial actions if success standards are not being met,
- reporting monitoring results to BLM annually, and
- requesting concurrence from BLM that success standards have been met and monitoring is no longer required.

BLM would be responsible for the following:

- evaluating annual monitoring reports,
- providing concurrence (or not) with the reclamation assessments as to whether or not success standards are being met and the rationale for the determination, and
- providing input on remedial actions to facilitate reclamation success (which may include requiring certain actions such as soil testing, soil amendments, irrigation, etc. that are not required by this plan).

Operators would submit annual reclamation evaluation reports to BLM by December 31 of each year and BLM would complete its above-referenced responsibilities by March 31 of the following year. This would enable Operators to make adjustments, if needed, prior to the next field season (summer) and reclamation season (fall).

B-5.2 MONITORING APPROACH

Monitoring would be largely qualitative because it is reasonably accurate to document the condition of a site in the field with a few basic notes and color photographs. The Monitoring Form provided as Table B-5.1 is designed to collect the appropriate data. The approach described herein is designed to allow reclamation inspectors a tool for evaluating reclamation status throughout the Jonah Field during a short period in the growing season, which would enable Operators to obtain a field-wide record on the status of reclamation. This record, then, would be used to make informed decisions on what actions are needed to obtain field-wide reclamation success, decisions that might range from a high-level action such as revising this Reclamation Plan to a simple remedial action such as installing a silt fence. The record would be key to tracking reclamation progress and initiating appropriate remedial actions for the LOP.

Field-wide monitoring would include existing and proposed facilities authorized under previous NEPA documents for the Jonah Field, as well as all infill operations that may be authorized in the future.

The qualitative evaluation may be supported by quantitative sampling such as the use of quadrats or transects to estimate vegetative cover. Quantitative or statistical sampling would only be conducted if it is deemed appropriate by the Operators or BLM or to settle any disagreements in the interpretation of the qualitative evaluation. The small sizes of the reclaim areas (especially on operating well pads and along the narrow linear corridors occupied by access roads and pipelines) do not lend themselves to the types of reclamation success studies conducted at the coal mines, so these types of studies are not recommended for the Jonah Field. Using a more qualitative approach will enable monitoring to be conducted at all reclamation areas within a reasonable time frame and for reasonable cost, while providing valuable data on the status of reclamation at each location. Thus, the determination of success, or lack thereof, would be based largely on the judgement of a suitable professional and would be supported by monitoring forms and color photographs.

Table B-5.1 Monitoring Form.

JONAH INFILL DRILLING PROJECT
RECLAMATION MONITORING FORM

Well Name/Number __________________ **Monitoring Date** _______________________

Well Spud Date ______________________ **Inspector** _____________________________

Circle 1 -- Well Pad, Access Road, Pipeline, Other Facility

Reclamation Data

Date Backfilled ____

Date Topsoiled ____

Topsoil Depth Replaced ____

Date Seeded ____

Seed Mixture ____

____

____

____

____

Other Reclamation Techniques Used ____

____

____

____

____

____

____

____

____

Table B-5.1 (Continued)

Monitoring Data

Answer Questions 1 - 6 to evaluate temporary reclamation
Answer Questions 1 - 11 to evaluate reclamation on sites that were reclaimed 4 or more years ago.
Answer Questions 1 - 6 and 12 - 18 to evaluate reclamation on sites that were reclaimed 10 or more years ago or where permanent reclamation success is to be documented.

Questions		Data		
		Yes	No	Comments (include photograph information)
1	Is the area free of undesirable materials (construction materials, trash, potentially hazardous materials)?			
2	Is the subsurface apparently stable, with no indications of subsidence, slumping, and/or significant downward movement of surface soil materials?			
3	Does the area appear stable (absence of rills or gullies that are actively eroding or greater than 2 inches wide/deep, perceptible soil movement, sheet flow, or head cutting in drainages and/or slope instability on or adjacent to reclaimed area)?			
4	Are soil surfaces adequately rough to reduce runoff and capture rainfall and snowmelt?			
5	Is vegetation helping to stabilize the site?			
6	Are weeds or other undesirable species adequately controlled?			
7	Is vegetative canopy cover at least 60% of the adjacent native undisturbed vegetative cover?			
8	Is there evidence of vegetative reproduction (either spreading by rhizomatous species or seed production)?			
9	Is vegetative cover at least 50% by species contained in the seed mix and/or present on adjacent areas?			
10	Does no single species account for more that 50% of total vegetative cover or if so does it make up more than 50% of total vegetative cover in adjacent undisturbed areas?			
11	Invasive, non-native species (weeds) or other undesirable species do not comprise more than 15% of total vegetative cover?			

Table B-5.1 (Continued)

Questions		Data		
		Yes	No	Comments (include photograph information)
12	Is vegetative canopy cover at least 80% of cover on adjacent native undisturbed vegetation?			
13	Is there evidence of vegetative reproduction (either spreading by rhizomatous species or seed production)?			
14	Is vegetative cover at least 90% by species contained in the seed mix, present on surrounding native vegetation, and/or by other desirable species?			
15	Does no single species account for more than 25% of total vegetative cover or if so does it make up more than 25% of total vegetative cover in adjacent undisturbed vegetation?			
16	Invasive, non-native species (weeds) or other undesirable species do not comprise more than 5% of total vegetative cover?			
17	Does the reclaimed landscape have characteristics that approximate the visual quality of the adjacent area?			
18	Does the reclaimed landscape support desired post-disturbance land uses?			

Use this worksheet to obtain data to answer questions 7-16.

Attribute	Reclaimed Area	Native Undisturbed Vegetation
Vegetative cover (%) by desirable species (note any species that comprises more than 25 - 50% of cover).		
Vegetative cover (%) by undesirable species		
Species list		
Description of evidence of reproduction by desirable species		Not Applicable

Table B-5.1 (Continued)

Additional Field Notes ____

Table B-5.1 (Continued)

Photographs of Reclaimed Area (attach additional sheets if needed).
Photograph 1
Photograph 2

The form presented in Table B-5.1 requires the revegetation success inspector to answer a series of questions about the site. The form provides for the monitoring of temporary reclamation, of sites where reclamation is 4 or more years old where only partial reclamation success is anticipated, and of sites where reclamation is 10 or more years old or for which permanent reclamation success is to be documented and monitoring discontinued. Monitoring permanent revegetation would commence during Year 2 because the desirable perennials typically would begin to dominate these reclaimed areas 1-3 years following reclamation and any erosion problems would be detected early. Monitoring Form questions are derived from the revegetation success standards described in Section B-2.2.

B-5.3 MONITORING TEMPORARY RECLAMATION

Temporary reclamation would be monitored annually and after large rain storms or snow melt runoff events.

Temporary reclamation monitoring would include visual inspection for undesirable materials, soil stability, the effectiveness of erosion control practices, vegetation establishment, and weed invasion. Monitoring results would be documented on the Monitoring Form (Table B-5.1) and color photographs would be taken. Where success Criteria 1-6 (see Section B-2.2) are not met (i.e., if any of Table B-5.1 questions 1-6 are answered "no"), Operators would correct the problem within 3 weeks of discovery.

B-5.4 MONITORING PERMANENT RECLAMATION

For permanent reclamation, reclamation success standards 1-6 (see Section B-2.2) would be monitored qualitatively (annually and after large rain storms or snow melt runoff events). Monitoring would include visual inspection for undesirable materials, soil stability, effectiveness of erosion control practices, and weed invasion. Monitoring results would be documented on the Monitoring Form (Table B-5.1) and color photographs would be taken. Where success Criteria 1-6 are not met (i.e., if any of Table B-5.1 questions 1-6 are answered "no"), Operators would correct the problem within 3 weeks of discovery.

Permanent revegetation monitoring (success standards 6a-6i; see Section B-2.2) would occur in Year 2 and annually thereafter until permanent reclamation success standards are achieved (standards 1-5, 6g, 6h, 6i, and 7). Operators may elect to conduct additional monitoring, and BLM may require additional monitoring if it is deemed warranted.

Permanent revegetation monitoring would include a visual inspection of the site to estimate percent cover by desirable and undesirable species and to compare vegetative canopy cover on the reclaimed area with that present on adjacent native vegetation. Quadrats or transects may be used to assist with cover estimates--if so, representative, rather than random, samples should be obtained. The inspector would note whether the desirable plants on the site appear to be reproducing. A list of the species present on reclaimed and adjacent vegetation would be developed and compared. These data would be recorded on the Monitoring Data Form (see Table B-5.1), and color photographs would be taken.

If any Monitoring Data Form questions 7-11 or 12-18 are answered "no" (i.e., revegetated areas do not meet all standards), additional treatments (e.g., discing and reseeding, addition of soil amendments, irrigation, herbicide application) and a treatment schedule would be developed in consultation with BLM and implemented as scheduled. All treatments would be applied within 1 year of determining that treatment is required.

This process will be reiterated as shown on Figure B-4.1.

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B-6.0 REFERENCES

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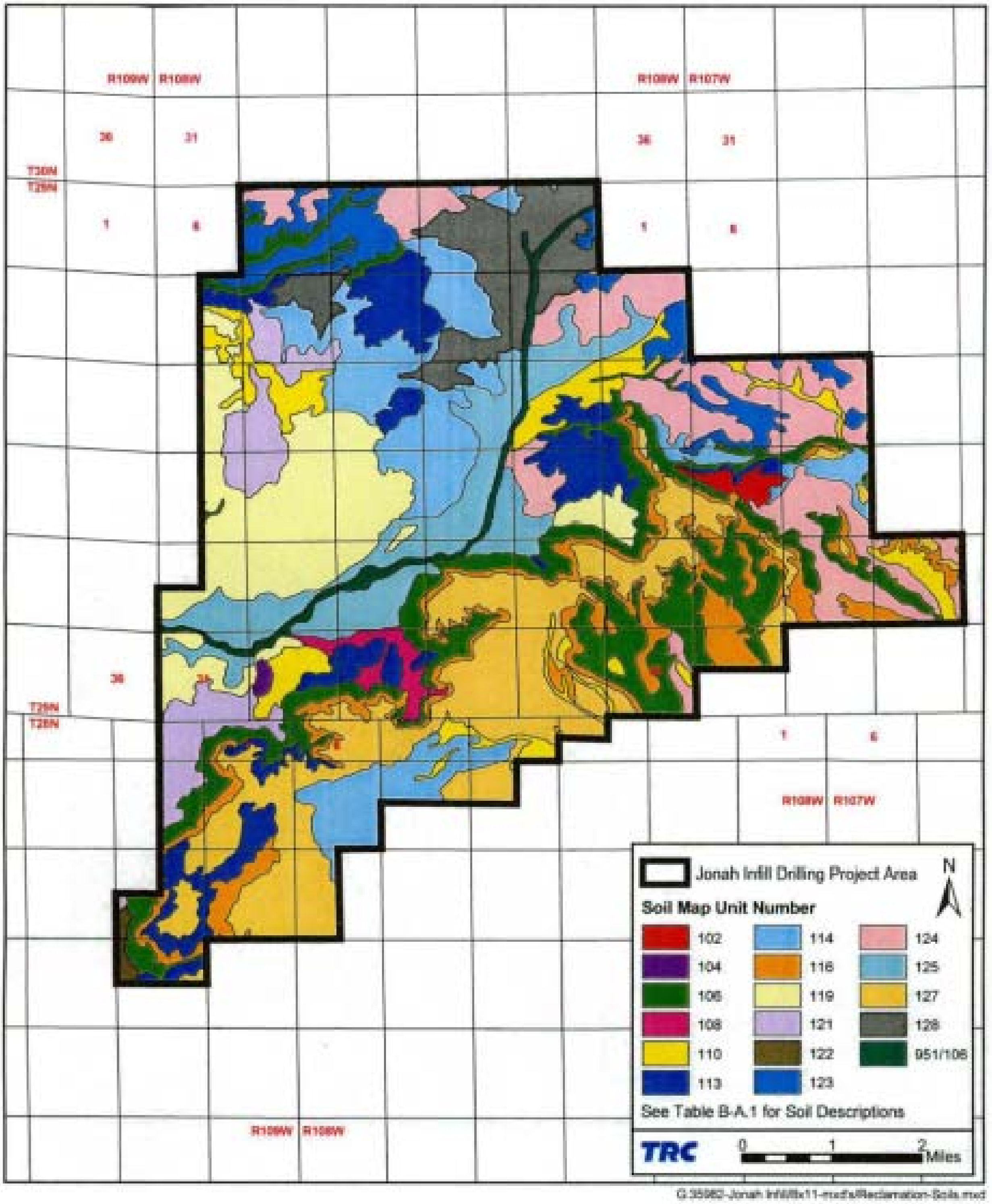
ADDENDUM B-A:

SOILS MAP AND TOPSOIL SALVAGE DEPTHS TABLE



Map B-A.1 Soils, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004

Table B-A.1 Soil Salvage Depths and Soil Characteristics for Project Area Soils, Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.[1]

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
102	12	1-10%	Langspring Variant	Loamy	0-10	L	7.9-8.4	<2	Low
					10-22	CL, SCL, L, SL	8.5-9.0	<2	--
					22-30	SCL, L, SL	7.9-8.4	<2	--
					30+	Sandstone	--	--	--
			Langspring	Loamy	0-9	L	7.9-8.4	<2	Low
					9-26	SCL, L, SL	8.5-9.0	<2	--
					26-40	SCL, L, SL	7.9-8.4	<2	--
104	--	0-2%	Chrisman	Saline upland	0-2	SIC, C, SICL	7.9-9.0	<2	Low
					2-60	SIC, C, SICL	77.8	>4	Low
106	12	1-6%	Monte	Loamy/ saline upland	0-2 2-60	L CL, L, SL	6.6-9.0 7.9-9.0	<2 <2	Low --
			Leckman	Loamy/	0-3	FSL, VFSL	7.9-9.0	<2	Low
				saline upland	3-60	FSL, VFSL	7.9-9.0	<2	--
108	12	0-3%	Dines	Saline upland	0-4	SIL	>7.8	8-16	Low
					4-21	SIL, SICL	>8.4	8-16	--
					21-60	SIL, SICL	>8.4	>16	--
			Clowers	Loamy	0-1	L	7.9-9.0	4-8	Low
					1-60	CL	7.9-9.0	4-8	--
			Quealman	Loamy	0-2	FSL, L, CL	7.4-8.4	<2	Low
					2-60	SR-LS-L-FSL	7.9-9.0	<2	--
110	12	1-8%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--
			Tresano	Loamy	0-2	SL	6.6-7.8	<2	Low
					2-16	SCL	6.6-9.0	<2	--
					16-60	SL	7.4-8.4	2-4	--

Table B-A.1 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
113	12	1-8%	Haterton	Shallow loamy	0-3	L	7.9-9.0	2-4	Moderate
					3-12	L	7.9-9.0	2-4	--
					12+	Siltstone	--	--	--
			Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	Moderate
					22+	Shale	--	--	--
114	4	1-8%	Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	Low
					1-19	SCL	6.6-7.8	<4	--
					19+	Shale-sandstone	--	--	--
			Ouard Variant	Shallow clayey	0-4	CL, L	6.6-7.8	<2	Low
					4-16	CL, C	7.4-9.0	<2	--
					16+	Shale	--	--	--
			Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	Moderate
					11+	Shale	--	--	--
116	9	6-30%	Huguston	Shallow loamy	0-9	SL, FSL	7.4-8.4	2-4	Moderate
					9+	Soft sandstone	--	--	--
			Horsley	Shale	0-3	L	7.4-9.0	2-4	Moderate
					3-9	L, CL, SCL	7.4-9.0	<16	--
					9+	Shale	--	--	--
			Terada	Loamy	0-7	VFSL, FSL, LS	7.4-8.4	<2	Moderate
					7-34	VFSL, FSL	7.4-9.0	<2	--
					34+	Sandstone	--	--	--
119	12	1-6%	Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	Low
					22+	Shale	--	--	--
			Monte	Loamy	0-2	L	6.6-9.0	<2	Low
					2-60	CL, L, SL	7.9-9.0	<2	--
121	10	1-6%	Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	Low
					22+	Shale	--	--	--

Table B-A.1 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
			Terada	Loamy/sandy	0-7	VFSL, FSL, LS	7.4-8.4	<2	Low
					7-34	VFSL, FSL	7.4-9.0	<2	--
					34+	Sandstone	--	--	--
			Langspring Variant	Loamy	0-10	L	7.9-8.4	<2	Low
					10-22	CL, SCL, L, SL	8.5-9.0	<2	--
					22-30	SCL, L, SL	7.9-8.4	<2	--
					30+	Sandstone	--	--	--
122	0	0-6%	Baston	Clayey	0-3	FSCL	8.0-9.0	<2	Low
					3-28	C	>8.4	<4	--
					28+	Shale	--	--	--
			Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	Moderate
					11+	Shale	--	--	--
			Chrisman	Clayey/	0-2	SIC, C, SICL	7.9-9.0	<2	Low
				saline upland	2-60	SIC, C, SICL	>7.8	<4	--
123	4	4-25%	Spool Variant	Shallow sandy	0-6	LFS, GR-SL	6.6-7.3	<2	Moderate to high
					6-12	LFS, CN-LFS,	6.6-7.8	<2	--
						GR-SL, GR-S	--	--	--
					12+	Sandstone	--	--	--
			Ouard Variant	Shallow clayey	0-4	CL, L	6.6-7.8	<2	Moderate
					4-16	CL, C	7.4-9.0	<2	--
					16+	Shale	--	--	--
			San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	Low to moderate
					4-14	SCL, SL	6.1-8.4	<2	--
					14-25	LCOS, COS, GRV-S	6.6-8.4	<4	--
					25+	Soft sandstone	--	--	--
124	6	3-8%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low

Table B-A.1 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--
			Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	Low
					1-19	SCL	6.6-7.8	<4	--
					19+	Shale-sandstone	--	--	--
			San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	Low
					4-14	SCL, SL	6.1-8.4	<2	--
					14-25	LCOS, COS, GRV-S	6.6-8.4	<4	--
					25+	Soft sandstone	--	--	--
125	6	0-3%	San Arcacio	Sandy/loamy	0-3	SL, COSL	6.6-8.4	<8	Low
					3-14	SCL, SL	6.6-8.4	<2	--
					14-60	GRV-S, GR-SL, LCOS	7.4-8.4	<4	--
			Saguache	Loamy/sandy	0-6	SL, COSL, GR-SL	6.6-9.0	<2	Low
					6-60	GRV-S, COS, GRV-LS	6.6-9.0	<2	--
127	3	0-3%	Vermillion Variant	Shallow loamy	0-3	L	6.6-8.4	<2	Low
					3-8	CN-L, CN-CL	7.4-8.4	<4	--
					8-27	FLX-L, FLV-CL, FLV-L	7.9-8.4	<4	--
					27+	Hard mudstone	--	--	--
			Seedskadee	Shallow loamy	0-14	SCL, L, SL	7.0-8.5	<2	Low
					14+	Hard sandstone	--	--	--
			Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--

Table B-A.1 (Continued)

Map Unit No.	Topsoil Salvage Depth[2] (inches)	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[3]	Reaction pH	Salinity (mmhos/cm)	Erosion Hazard
128	12	0-3%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	Low
					4-22	SCL	6.6-7.8	<2	--
					22-34	SL, SCL	7.4-8.4	2-4	--
					34+	Soft sandstone	--	--	--
			Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	Low
					1-19	SCL	6.6-7.8	<4	--
					19+	Shale-sandstone	--	--	--
			San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	Low
					4-14	SCL, SL	6.1-8.4	<2	--
					14-25	LCOS, COS, GRV-S	6.6-8.4	<4	--
					25+	Soft sandstone	--	--	--
951[2]/106	--	0-2%/see 106	Cowestglen	Overflow	0-3	CL	7.4-8.4	0	--
					3-8	CL	7.4-8.4	0	--
					8-60	CL	7.4-8.4	0	--

1 Adapted from ERO Resources Corporation (1988).

2 Criteria used to determine topsoil salvage depth: maximize loamy textures; minimize clayey textures, rock content, and salinity; salvage at least 6 inches if possible; salvage greater depths in better soils to a) provide a deeper seedbed and b) compensate for insufficient soils at other locations.

3 U.S. Department of Agriculture Texture.

C	Clay	FSL	Fine sandy loam	SCL	Sandy clay loam
CL	Clay loam				Silty clay
COS	Coarse sand	LCOS	Loamy coarse sand	SICL	Silty clay loam
COSL	Coarse sandy loam	LFS	Loamy fine sand	SIL	Silt loam
FS	Fine sand	L	Loam		Loamy sand
				SIC	Sandy loam
FSCL	Fine Sandy clay loam	S	Sand	VFSL	Very fine sandy loam

Texture Modifier:

CN	Channery	GR	Gravelly	SL
FLV	Very flaggy	GRV	Very gravelly	
	Extremely flaggy	SR	Stratified	

FLX LS

APPENDIX C:

HAZARDOUS MATERIALS MANAGEMENT SUMMARY,
JONAH INFILL DRILLING PROJECT

APPENDIX C:

HAZARDOUS MATERIALS MANAGEMENT SUMMARY, JONAH INFILL DRILLING PROJECT

Prepared for

Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

Bureau of Land Management
Pinedale Field Office
Pinedale, Wyoming

and

Bureau of Land Management
Rock Springs Field Office
Rock Springs, Wyoming

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 35982

February 2005

TABLE OF CONTENTS

LIST OF TABLES

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C-1.0 INTRODUCTION

This Hazardous Materials Management Summary is provided pursuant to Bureau of Land Management (BLM) *Instruction Memoranda Numbers WO-93-344* and *WY-94-059*, which require that all *National Environmental Policy Act* (NEPA) documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. The summary serves as a supplement to the Jonah Infill Drilling Project environmental impact statement (EIS).

Materials are considered hazardous if they contain chemicals or substances listed in the Environmental Protection Agency's (EPA's) Consolidated List of Chemicals Subject to Reporting Under Title III of the *Superfund Amendments and Reauthorization Act of 1986* (SARA). Extremely hazardous materials are those identified in the EPA's List of Extremely Hazardous Substances (40 *Code of Federal Regulations* [C.F.R.] 355).

Project proponents (Encana Oil & Gas [U.S.A.], Inc. [EnCana] and BP America Production Company [BP America]; referred to as “Operators”) have reviewed the EPA's Consolidated List of Chemicals Subject to Reporting Under Title III of SARA (as amended) to identify any hazardous substances proposed for production, use, storage, transport, or disposal by this project, as well as the EPA's List of Extremely Hazardous Substances as defined in 40 C.F.R. 355 (as amended) and have determined that various materials listed as hazardous and/or extremely hazardous would be used or generated by this project. All known hazardous and extremely hazardous materials potentially produced, used, stored, transported, and/or disposed of as a result of the project are presented in Table C-1.1.

Hazardous materials anticipated to be used or produced during implementation of the proposed project generally can be included in the following categories: drilling materials, cementing and plugging materials, fracturing materials, production products, fuels, pipeline materials, emissions, compressor station materials, and miscellaneous materials. Where possible, the quantities of these products or materials have been estimated on a per-well basis (Table C-1.1).

Table C-1.1 Hazardous and Extremely Hazardous Materials Potentially Utilized or Produced During Construction, Drilling, Production, and Reclamation Operations by the Jonah Infill Drilling Project, Sublette County, Wyoming, 2004.

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Drilling Materials				
Anionic polyacrylamide	20 lbs		Acrylamide	79-06-1
Barite	16,000 lbs	Barium compounds		--
		Fine mineral fibers		--
Bentonite	45,000 lbs	Fine mineral fibers		--
Caustic soda	750 lbs	Sodium hydroxide		1310-73-2
Glutaraldehyde	20 gal	Isopropyl alcohol		67-63-0
Lime	3,500 lbs	Calcium hydroxide		1305-62-0
Mica	600 lbs	Fine mineral fibers		--
Modified tannin	250 lbs	Ferrous sulfate		7720-78-7
		Fine mineral fibers		--
Phosphate esters	100 gal	Methanol		67-56-1
Polyacrylamides	100 gal		Acrylamide	79-06-1
		PAHs[4]		--
		Petroleum distillates		64742-47-8
		POM[5]		--
Polyanionic cellulose	600 lbs	Fine mineral fibers		
Retarder	400 lbs	Fine mineral fibers		--
Cementing and Plugging Materials				
Bentonite	15,000 lbs	Fine mineral fibers		
Anti-foamer	100 lbs	Glycol ethers		--
Calcium chloride flake	2,500 lbs	Fine mineral fibers		--
Cellophane flake	300 lbs	Fine mineral fibers		--
Cements	77,000 lbs	Aluminum oxide		1344-28-1
		Fine mineral fibers		--
Chemical wash	850 gal	Ammonium hydroxide		1336-21-6
		Glycol ethers		--
Diatomaceous earth	1,000 lbs	Fine mineral fibers		--
Extenders	17,500 lbs	Aluminum oxide		1344-28-1
		Fine mineral fibers		--
Fluid loss additive	900 lbs		Acrylamide	79-06-1
		Fine mineral fibers		--
		Napthalene		91-20-3
Friction reducer	160 lbs	Fine mineral fibers		--
		Napthalene		91-20-3
		PAHs		--
		POM		--
Mud flash	250 lbs	Fine mineral fibers		--
Retarder	100 lbs	Fine mineral fibers		--
Salt	2,570 lbs	Fine mineral fibers		--
Silica flour	4,800 lbs	Fine mineral fibers		--
Fracturing Materials				
Biocides	6 gal	Fine mineral fibers		--
		PAHs		--
		POM		--

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Fracturing Materials (cont.)				
Breakers	145 lbs	Ammonium persulphate		7727-54-0
		Ammonium sulphate		7783-20-2
		Copper compounds		--
		Ethylene glycol		107-21-1
		Fine mineral fibers		--
		Glycol ethers		--
Clay stabilizer	50 gal	Fine mineral fibers		--
		Glycol ethers		--
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		--
		POM		--
Crosslinkers	60 gal	Ammonium chloride		12125-02-9
		Methanol		67-56-1
		Potassium hydroxide		1310-58-3
		Zirconium nitrate		13746-89-9
		Zirconium sulfate		14644-61-2
Foaming agent	120 gal	Glycol ethers		--
Gelling agent	950 gal	Benzene		71-43-2
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Napthalene		91-20-3
		PAHs		--
		POM		--
		Sodium hydroxide		1310-73-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
pH buffers	60 gal	Acetic acid		64-19-7
		Benzoic acid		65-85-0
		Fumaric acid		110-17-8
		Hydrochloric acid		7647-01-0
		Sodium hydroxide		1310-73-2
Sands	2,000,000 lbs	Fine mineral fibers		--
Solvents	50 gal	Glycol ethers		--
Surfactants	15 gal	Glycol ethers		--
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		--
		POM		--
Production Products				
Liquid hydrocarbons	<5-36 bpd	Benzene		71-43-2
		Ethyl benzene		100-41-4
		n-Hexane		110-54-3
		PAHs		--
		POM		--
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Production Products (cont.)				
Natural gas	0.5->4.0 mmcfd	n-Hexane		110-54-3
		PAHs		--
		POM		--
Produced water/cuttings	1.0-20.0 bpd water and an unknown quantity of cuttings	Arsenic		7440-38-2
		Barium		7440-39-3
		Cadmium		7440-43-9
		Chromium		7440-47-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Mercury		7439-97-6
		Radium 226		--
		Selenium		7782-49-2
		Uranium		--
		Other radionuclides		--
Fuels				
Diesel fuel	>36,300 gal	Benzene		71-43-2
		Cumene		98-82-8
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		--
		POM		--
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Gasoline	Unk	Benzene		71-43-2
		Cumene		98-82-8
		Cyclohexane		110-82-7
		Ethylbenzene		100-41-4
		n-Hexane		110-54-3
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		--
		POM		--
			Tetraethyl lead	78-00-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Natural gas	Unk	n-Hexane		110-54-3
		PAHs		--
		POM		--
Propane	Unk	Propylene		115-07-1
Pipeline Materials				
Coating	Unk	Aluminum oxide		1334-28-1
Cupric sulfate solution	Unk	Cupric sulfate		7758-98-7
		Sulfuric acid		7664-93-9
Diethanolamine	Unk	Diethanolamine		111-42-2
LP Gas	Unk	Benzene		71-43-2
		n-Hexane		110-54-3
		Propylene		115-07-1
Molecular sieves	Unk	Aluminum oxide		1344-28-1

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Pipeline Materials (cont.)				
Pipeline primer	Unk	Naphthalene		91-20-3
		Toluene		108-88-3
Potassium hydroxide solution	Unk	Potassium hydroxide		1310-58-3
Rubber resin coatings	Unk	Acetone		67-64-1
		Coal tar pitch		68187-57-5
		Ethyl acetate		141-78-6
		Methyl ethyl ketone		78-93-3
		Toluene		108-88-3
		Xylene		1330-20-7
Emissions				
Gases	Unk	Formaldehyde		50-00-0
			Nitrogen dioxide	10102-44-0
			Ozone	10028-15-6
			Sulfur dioxide	7446-09-5
			Sulfur trioxide	7446-11-9
Hydrocarbons	Unk	Benzene		71-43-2
		Ethylbenzene		100-41-4
		n-Hexane		100-54-3
		PAHs		--
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Particulate matter	Unk	Barium		7440-39-3
		Cadmium		7440-43-9
		Copper		7440-50-8
		Fine mineral fibers		--
		Lead		7439-92-1
		Manganese		7439-96-5
		Nickel		7440-02-0
		POM		--
		Zinc		7440-66-6
Compressor Station Materials				
Coolants	Unk	Ethylene glycol		107-21-1
Crude Oil	Unk	Benzene		71-43-2
		PAHs		--
		POM		--
Grease	Unk	Zinc compounds		--
Heat Transfer Fluid	Unk	Benzene		71-43-2
Lubricants	Unk	1,2,4-trimethylbenzene		95-63-6
		Barium		7440-39-3
		Cadmium		7440-43-9
		Copper		7440-50-8
		n-Hexane		110-54-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Nickel		7440-02-0
		PAHs		--
		POM		--
		Zinc		7440-66-6
Methanol	Unk	Methanol		67-56-1

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Compressor Station Materials (cont.)				
Natural Gas Liquids	Unk	Benzene		71-43-2
		Hexane		110-54-3
			Hydrogen Sulfide[6]	7783-06-4
Marking Paints	Unk	Hexane		110-54-3
		Naphthalene		91-20-3
		Toluene		108-88-3
		Xylene		1330-20-7
		Acetone		67-64-1
		Cyclohexane		110-82-7
Primers	Unk	Acetone		67-64-1
		Methanol		67-56-1
		Methyl Ethyl Ketone		78-93-3
		Napthalene		91-20-3
		Toluene		108-88-3
		Xylene		1330-20-7
		Zinc		7440-66-6
Plant Condensate	Unk	Benzene		71-43-2
		Ethyl benzene		100-41-4
		n-Hexane		110-54-3
		PAHs		--
		POM		--
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Silicone Seal	Unk	Silane		3037-72-7
Miscellaneous Materials				
Acids	Unk	Acetic anhydride		108-24-7
		Formic acid		64-18-6
		Sodium chromate		777-11-3
		Sulfuric acid		7664-93-9
Antifreeze, heat control, and dehydration agents	300 gal	Acrolein		107-02-8
		Cupric sulfate		7758-38-7
		Ethylene glycol		107-21-1
		Freon		76-13-1
		Phosphoric acid		766-38-2
		Potassium hydroxide		1310-58-3
		Sodium hydroxide		1310-73-2
		Triethylene glycol		112-27-6
Batteries	Unk	Cadmium		7440-43-9
		Cadmium oxide		1306-19-0
		Lead		7439-92-1
		Nickel hydroxide		7440-02-0
		Potassium hydroxide		1310-58-3
		Sulfuric acid		7664-93-9
Biocides	Unk	Formaldehyde		50-00-0
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
Cleaners	Unk	Hydrochloric acid		7647-01-0

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Miscellaneous Materials (cont.)				
Corrosion inhibitors	Unk	4-4' methylene dianiline		101-77-9
		Acetic acid		64-19-7
		Ammonium bisulfite		10192-30-0
		Basic zinc carbonate		3486-35-9
		Diethylamine		109-89-7
		Dodecylbenzenesulfonic acid		27176-87-0
		Ethylene glycol		107-21-1
		Isobutyl alcohol		78-83-1
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		Napthalene		91-20-3
		Sodium nitrite		7632-00-0
		Toluene		108-88-3
		Xylene		1330-20-7
Emulsion breakers	Unk	Acetic acid		64-19-7
		Acetone		67-64-1
		Ammonium chloride		12125-02-9
		Benzoic acid		65-85-0
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		Napthalene		91-20-3
		Toluene		108-88-3
		Xylene		1330-20-7
		Zinc chloride		7646-85-7
Fertilizers	Unk	Unk		--
Herbicides	Unk	Unk		--
Lead-free thread compound	25 gal	Copper		7440-50-8
		Zinc		7440-66-6
Lubricants	Unk	1,2,4-trimethylbenzene		95-63-6
		Barium		7440-39-3
		Cadmium		7440-43-9
		Copper		7440-50-8
		n-Hexane		110-54-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Nickel		7440-02-0
		PAHs		--
		POM		--
		Zinc		7440-66-6
Methanol	200 gal	Methanol		67-56-1
Motor oil	220 gal	Zinc compounds		--

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Miscellaneous Materials (cont.)				
Paints	Unk	Aluminum		7429-90-5
		Barium		7440-39-3
		n-Butyl alcohol		71-36-3
		Cobalt		7440-48-4
		Lead		7439-92-1
		Manganese		7439-96-5
		PAHs		--
		POM		--
		Sulfuric acid		7664-93-9
		Toluene		108-88-3
		Triethylamine		121-44-8
		Xylene		1330-20-7
Paraffin control	Unk	Carbon disulfide		75-15-0
		Ethylbenzene		100-41-4
		Methanol		67-56-1
		Toluene		108-88-3
		Xylene		1330-20-7
Photoreceptors	Unk	Selenium		7782-49-2
Scale inhibitors	Unk	Acetic acid		64-19-7
		Ethylene diamine tetra		60-00-4
		Ethylene glycol		107-21-1
		Formaldehyde		50-00-0
		Hydrochloric acid		7647-01-0
		Isopropyl alcohol		67-63-1
		Methanol		67-56-1
		Nitrilotriacetic acid		139-13-9
Sealants	Unk	1,1,1-trichloroethane		71-55-6
		n-Hexane		110-54-3
		PAHs		--
		POM		--
Solvents	Unk	1,1,1-trichloroethane		71-55-6
		Acetone		67-64-1
		t-Butyl alcohol		75-65-0
		Carbontetrachloride		56-23-5
		Isopropyl alcohol		67-63-0
		Methyl ethyl ketone		108-10-1
		Methanol		67-56-1
		PAHs		--
		POM		--
		Toluene		108-88-3
		Xylene		1330-20-7
Starting fluid	Unk	Ethyl ether		60-29-7
Surfactants	Unk	Ethylene diamine		107-15-3
		Isopropyl alcohol		67-56-1
		Petroleum naphtha		8030-30-6

1 lbs = pounds; gal = gallons; bpd = barrels per day; mmcfd = million cubic feet per day; Unk = quantity unknown.
2 Hazardous substances are those constituents listed under the Consolidated List of Chemicals Subject to Reporting Under Title III of the S*uperfund Amendments and Reauthorization Act of 1986 (*SARA*),* as amended.
3 Extremely hazardous substances are those defined in 40 C.F.R. 355.
4 PAHs = polynuclear aromatic hydrocarbons.
5 POM = polycyclic organic matter.
6 If hydrogen sulfide is present, it occurs at 5% or less of liquid gas component.

C-2.0 DRILLING MATERIALS

Water-based drilling fluids consisting of clays and other additives would be utilized by drilling companies for drilling each well; however, although not currently proposed for use, oil-based drilling fluids may be proposed for use at some wells. Drilling fluid additives potentially containing hazardous materials are listed in Table C-1.1. The polyacrilamides used in drilling may contain the extremely hazardous substance acrylamide. Drilling fluid additives would be transported to well pads during drilling operations in appropriate sacks and containers. Water-based drilling fluids, cuttings, and water would be stored in reserve pits located on-site, and reserve pits would be lined as directed by the BLM to conserve water and to protect near-surface aquifers. When the reserve pit is no longer required, its contents would be evaporated or solidified in place, and the pit would be backfilled as approved by the BLM. If oil-based drilling fluids are used, these fluids would be contained in a closed system (a series of tanks) to prevent their release to the environment. Oil-based drilling fluids would be reused for drilling other wells or, as for other potentially hazardous materials, removed from the field for disposal at an authorized off-site facility (e.g., the R&G Oil Field Waste Disposal-Shute Creek Site and/or the R&G Piney Co. Field Waste Disposal Facility).

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C-3.0 CEMENTING AND PLUGGING MATERIALS

Well completion and abandonment operations include cementing and plugging various segments of the well bore to protect freshwater aquifers and other down-hole resources. Wells would be cased and cemented as approved by the BLM (for federal minerals) and Wyoming Oil and Gas Conservation Commission (WOGCC) (for state minerals). Cementing and plugging materials potentially containing hazardous materials are listed in Table C-1.1. The extremely hazardous material acrylamide may be present in fluid loss additives. All casing and plugging materials would be transported in bulk to each well site. Small quantities may be transported and stored on-site in appropriate containers.

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C-4.0 FRACTURING MATERIALS

Hydraulic fracturing would be performed at all proposed wells to enhance gas flow rates. Fracturing fluids consist primarily of fresh water but would contain some additives with hazardous constituents as shown in Table C-1.1. Fracturing materials would be transported to well locations in bulk or in manufacturer's containers. Waste fracturing fluids would be collected in aboveground tanks and/or reserve pits and evaporated, hauled away from the well pad and reused at another well, or disposed of at an authorized facility.

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C-5.0 PRODUCTION PRODUCTS

C-5.1 NATURAL GAS

Produced natural gas primarily would contain methane, ethane, and carbon dioxide. Hazardous substances potentially present in the gas stream are listed in Table C-1.1. No extremely hazardous materials are anticipated to be present. Small quantities of natural gas may be flared into a flare pit during well testing operations, pursuant to BLM/WOGCC rules and regulations (Notice to Lessees [NTL]-4A); however, with the use of high pressure separators, these emissions would be dramatically reduced from levels previously released at the Jonah Field. BLM and WOGCC approval would be necessary prior to flaring operations. No natural gas would be stored on-site.

C-5.2 LIQUID HYDROCARBONS

Condensates would be produced in association with the gas stream from productive wells. Hazardous materials potentially present in the liquid hydrocarbons are listed in Table C-1.1. No extremely hazardous materials are known to be present in these liquid hydrocarbons.

Liquid hydrocarbons would be stored in tanks at well pads, and all tanks would be bermed to contain 110% of the entire storage capacity of the largest tank. Liquid hydrocarbons periodically would be removed from storage tanks and transported by truck off the project area for sale to refineries. All necessary authorizing actions for the production, storage, and transport of liquid hydrocarbons would be addressed prior to the initiation of production activities.

C-5.3 PRODUCED WATER

Hazardous materials potentially present in trace amounts in produced water are listed in Table C-1.1. No extremely hazardous materials are expected in the produced water.

Produced water would be stored in tanks at well locations and periodically would be removed and transported to Wyoming Department of Environmental Quality (WDEQ)- or WOGCC-permitted water disposal facilities (e.g., treatment/evaporation facilities, underground injection wells). Produced water quality from wells and in-field treatment facilities would be monitored periodically, and water that meets applicable standards would be discharged to the surface at appropriate locations. Further detail on existing and proposed produced water disposal methodologies is provided in EIS Section 2.6.8 (Production Operations).

Necessary authorizing actions that must be met prior to the disposal of produced water include the following:

- BLM approval of disposal methodologies;
- *Resource Conservation and Recovery Act* compliance, as necessary;
- WDEQ Water Quality Division approval of wastewater disposal (e.g., National Pollution Discharge Elimination System permits);
- WOGCC evaporation pond permits; and
- Wyoming State Engineer's Office dewatering permits (Form U.W. 5).

C-6.0 FUELS

Diesel fuel, gasoline, natural gas, and propane would be used for the project. All contain hazardous materials (see Table C-1.1). Gasoline and diesel would be used by vehicles providing transport to and from the project area. Diesel fuel also be used in drilling operations and construction equipment and as a minor component of fracturing fluids and may be used in oil-based drilling fluids. Natural gas produced by the proposed project would be used to power production equipment burners, gas-activated valves, pipeline compressor stations, and other ancillary facilities. Propane would be utilized for miscellaneous heating purposes.

C-6.1 GASOLINE

Gasoline is known to contain hazardous materials (see Table C-1.1). Gasoline for this project would be purchased from regional vendors and primarily would be stored and transported in vehicle gas tanks. Some additional gasoline storage may be provided in appropriately designed and labeled 1- to 5-gal containers for supplemental use as vehicle fuel. No large-scale storage of gasoline is anticipated. Tetraethyl lead, an extremely hazardous material, is present in leaded gasoline (regular).

C-6.2 DIESEL FUEL

Diesel fuel for use as a fuel would be similar to that described for gasoline. Each well location would have aboveground storage tanks containing diesel fuel during drilling operations. Tanks would be filled by a local fuel supplier. The use, transport, and storage of diesel fuel would be conducted in accordance with all relevant state and/or federal rules, regulations, and guidelines.

C-6.3 NATURAL GAS

Natural gas produced on-site would be burned to provide power for compressor stations and other ancillary facilities. Hazardous materials are known to be present in natural gas (see Table C-1.1). No extremely hazardous materials are known to exist in the natural gas from the project area.

C-6.4 PROPANE

The only hazardous material known to be present in propane is propylene. No extremely hazardous materials are known to be present. Propane would be purchased from regional vendors and would be stored and transported in appropriate propane tanks. No large-scale storage of propane is anticipated.

C-7.0 PIPELINE MATERIALS

Gas produced from wells would be transported from each well through pipelines linking wells with existing natural gas gathering systems. Industry-standard pipeline equipment, materials, techniques, and procedures in conformance with all applicable regulatory requirements would be employed during construction, testing, operation, and maintenance of the project to ensure pipeline safety and efficiency. All necessary authorizing actions for natural gas pipelines would be addressed prior to installation. These actions may include the following:

- Sublette County special use permits;
- BLM right-of-way (ROW) grants;
- BLM Sundry Notices;
- conformance with Department of Transportation pipeline regulations (49 C.F.R. 191-192); and
- Wyoming Public Service Commission Certificates to act as common carrier for natural gas.

Materials utilized for pipeline construction, operation, and maintenance that may contain hazardous materials are listed in Table C-1.1. Hazardous materials associated with pipeline construction, operation, and maintenance would be handled in accordance with applicable state and federal regulations.

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C-8.0 EMISSIONS

Emissions from combustion engines and condensate flashing; well construction, completion, and production; and pipeline construction, operation, and maintenance would occur as a result of this project. Hazardous and extremely hazardous materials are known to be released directly or formed secondarily (i.e., ozone) from the construction and operation of natural gas wells and associated pipelines (Table C-1.1). Extremely hazardous emission materials include nitrogen dioxide, ozone, sulfur dioxide, and sulfur trioxide. No releases of these hazardous and extremely hazardous materials are anticipated to exceed quantities allowed for in Prevention of Significant Deterioration Class II areas of the WDEQ-Air Quality Division Implementation Plan, nor are combustion emissions expected to exceed Wyoming Ambient Air Quality Standards or National Ambient Air Quality Standards. Particulate matter emissions and larger unburned hydrocarbons eventually would settle out on the ground surface, whereas gaseous emissions would react with other air constituents as components of the nitrogen, sulfur, and carbon cycles.

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C-9.0 COMPRESSOR STATIONS

Materials potentially containing hazardous substances that are used at compressor stations are listed in Table C-1.1. Quantities of these materials are unknown but consist of fuels, lubricants, paints, primers, and combustion products. The extremely hazardous material hydrogen sulfide may be present as a minor component in natural gas liquids. Natural gas liquids are burnt as a secondary fuel source at compressor stations.

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C-10.0 MISCELLANEOUS MATERIALS

Miscellaneous materials potentially containing hazardous substances that may be used for the proposed project are listed in Table C-1.1. Quantities of these materials are unknown; however, no extremely hazardous substances are known to be present in any of these materials. Miscellaneous materials would be used during well construction and production operations; for well, pipeline, and equipment maintenance; and during reclamation activities.

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C-11.0 MANAGEMENT POLICY AND PROCEDURE

Each individual Operator would be responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials as a result of the proposed project would be in accordance with all applicable existing or hereafter promulgated federal, state, and local government rules, regulations, and guidelines. All project-related activities involving the production, use, and/or disposal of hazardous or extremely hazardous materials would be conducted to minimize potential environmental impacts (Amoco Production Company [now BP America] 1993, 1995; EnCana 2002a).

Each Operator would comply with emergency reporting requirements for releases of hazardous materials. Any release of hazardous or extremely hazardous substances (leaks, spills, etc.) in excess of the reportable quantity, as established in 40 C.F.R. 117, would be reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as amended (*42 United States Code* [U.S.C.] 9601 et seq.). The materials for which such notification must be given are the extremely hazardous substances listed under the *Emergency Planning and Community Right to Know Act*, Section 302, and the hazardous substances designated under Section 102 of CERCLA, as amended. If the release of a hazardous/extremely hazardous substance in a reportable quantity does occur, immediate notice and reporting must be given to the BLM and to all other appropriate federal and state agencies as defined in BLM NTL-3A. Incidents requiring verbal notification would be given as soon as possible but no later than 24 hours after discovery. Verbal notification would be confirmed in writing within 15 days or other such time required by the appropriate regulatory agency.

Each Operator would prepare and implement, as necessary, the following plans and/or policies:

- pursuant to 40 C.F.R. 112, Spill Prevention, Control, and Countermeasure Plans (SPCCPs) for those sites where SPCCPs are applicable (see EnCana 2002b);
- spill response plans (EnCana 2002b);

- plans and inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended;
- Emergency Response Plans (see EnCana 2002b); and
- Storm Water Pollution Prevention Plans (SWPPPs) (see McMurry Oil Company 2003).

Copies of the above would be maintained with the Operators, as required by regulation, and would be made available upon request.

During the course of routine oil and gas production operations, minor leaks, spills, and other accidental releases of crude oil and condensate may occur, thereby creating hydrocarbon-impacted soils. While the surface use lease may allow for the temporary storage and treatment of oil-contaminated soils on well pads, some Operators discourage this practice in an effort to maintain environmental integrity. As a Best Management Practice (BMP), one Operator plans to transport, accumulate, and treat these contaminated soils at a new bioremediation facility dedicated solely to the remediation of these soils (EnCana 2003).

This proposed ancillary facility would be located on state surface in the SW¼ NE¼, Section 36, T29N, R108W. The dimensions of the facility would be 200 x 200 ft. Containment berm walls 2 ft high x 4 ft wide would be located on the east, south, and west perimeters of the pad to contain storm water runoff. Erosion controls would be installed on the soil berms and pad shoulders to maintain their integrity, and walls and shoulders would be revegetated during operations.

All weather year-round access to the facility would be maintained, and the facility would be gated and locked.

Point sources for hydrocarbon-impacted soils are wellhead and production battery spills and releases, as well as gas and flow line leaks. The typical range of hydrocarbon contamination, expressed as total recoverable petroleum hydrocarbons (TRPH), is from <500 parts per million (ppm) to >20,000 ppm depending on such factors as spill volume, exposure time, and weather.

Hydrocarbon-impacted soils would be treated at the facility by enhancing hydrocarbon degradation with indigenous bacteria. Impacted soils would be placed in windrows approximately 10 ft wide x 120 ft long and 24 inches deep. On a scheduled basis, the soil mass in each windrow would be turned to continually expose soil mass layers to oxygen, moisture, and sunlight. No tillage of the soils would occur during periods of high winds or when surface conditions would create fugitive dust emissions.

Impacted soils received at the facility that reflect hydrocarbon concentrations in excess of 20,000 ppm TRPH would be blended with soils exhibiting lower hydrocarbon concentrations to avoid pockets of high hydrocarbon concentrations in soil masses.

When an individual windrow is filled to designated dimensions and volumes, hydrocarbon concentrations would be periodically measured using an organic vapor meter (OVM). When OVM readings indicate that hydrocarbon concentrations have dropped to <1,000 ppm, a composite sample of the soil mass would be collected for TRPH analysis. When TRPH concentrations have dropped below WOGCC TRPH-concentration limits, the soil mass would be removed from the facility for recycling under a variety of beneficial uses approved and stipulated by the WOGCC. The primary use of remediated soils from this facility would be construction related (e.g., road grades).

As necessary, development operations would also be in compliance with regulations promulgated under the *Resource Conservation and Recovery Act, Federal Water Pollution Control Act* (the *Clean Water Act*), *Safe Drinking Water Act, Toxic Substances Control Act, Occupational Safety and Health Act*, and the *Federal Clean Air Act*. In addition, project operations would comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

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