DECISION RECORD
Anadarko Petroleum Company, Powder River 2D Seismic Survey
Environmental Assessment (EA), WY-070-EA11-343
Buffalo Field Office, Bureau of Land Management

Lease/Serial/Case File No.: **WYW170238**
Recommendation/Rationale: I approve Dawson Geophysical Company (DG) Notice of Intent (NOI) to conduct geophysical exploration operations on public lands administered by the BLM in the Powder River 2D Seismic Survey (PR2SS) project area with the mitigation measures described below. The Anadarko Petroleum Company (APC) will use the subsurface information gathered by this project to explore for and develop the oil and gas resources in this area. The subsurface data will limit unnecessary drilling, reduce surface disturbance, and reduce adverse impacts to other resources.

Compliance: This decision complies with:
- Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701).
- Mineral Leasing Act of 1920 (MLA) (30 U.S.C. 181); to include On Shore Order No. 1.
- National Environmental Policy Act of 1969 (NEPA) (42 USC 4321).
- National Historic Preservation Act of 1966
- Buffalo Resource Management Plan (RMP) 1985, Amendments 2001, 2003, 2011.
- Interior Department Order 3310.

BLM summarized the details of the approval of Alternative B below. The project description and site-specific mitigation measures, is included in the EA and conditions of approval (COAs).

Seismic Work Project Area Description:
BLM approves the following seismic work:

Dawson Geophysical has made some changes to the legal descriptions that are on the NOI because of line movements and surface access. Please note the sections that say "ALL" are because we may need access in the 2D area, but we will not know until the surveyors get on the ground.
Sheridan
54N-78W SEC 20, NENE, NESE, 53N-78W SEC 5 E2E2, NWNE
Johnson
53N-78W SEC 32 E2NE, SWNE, SESE, 52N-78W SEC 4 SWNE, W2, SE, SEC 5 N2NE, NW, N2SW, SEC 31 S2SE, SEC 32 S2NE, SENW, SEC 33 NE, E2W2, SWNW, W2SW, 52N-79W SEC 33 N2, SEC 34 NW, N2SW, SESW, 51N-78W SEC 1 S2NE, W2, SE, SEC 2 S2, SEC 3 E2NE, NESE, SEC 20 N2N2, 50N-78W SEC 5 ALL, SEC 8 ALL, SEC 17 ALL, SEC 20 N2N2, S2S2, SEC 29 ALL, 49N-78W SEC 8 ALL, SEC 17 ALL, SEC 20 E2, NW, N2SW, SEC 29 S2SW, 48N-78W SEC 19 S2, 48N-78W SEC 30 E2, 47N-78W SEC 19 W2NE, 46N-78W SEC 6 SE, SEC 7 E2, 51N-77W SEC 4 E2SE, SEC 6 S2, SEC 9 E2NE, SWNE, SEC 10 N2, NESE, SEC 11 W2, SEC 12 E2NE, SWNE, NWNW, SE, 51N-76W SEC 7 S2N2, S2, SEC 8 SWNW, S2
Campbell
51N-76W SEC 9 W2SW, SESW, SEC 10 E2, SESW, SEC 11 ALL, SEC 12 N2, SW, S2SE, NESE, 51N-75W SEC 13 SESW, SEC 14 SESW, SEC 15 W2SW

Limitations: There are no denials or deferrals. Also see the COAs.

THE FINDING OF NO SIGNIFICANT IMPACT (FONSI). Analysis of Alternative B of the EA, WY-070-EA11-343, and the FONSI found the DG and APC proposal for PR2SS will have no significant impacts on the human environment, beyond those described in the PRB FEIS, thus an EIS is not required.

DECISION RATIONALE:
I base the decision authorizing the selected project, as summarized above, on the following:

1. Mitigation measures were included to reduce environmental impacts while meeting the project's need. For a complete description of all site-specific COA's associated with this approval, see the EA, its Appendices A-E, and COAs.

2. The affected public land in the project area is intermingled with private lands. The approval of the NOI is only for geophysical operations on public lands. The Wyoming Oil and Gas Conservation Commission authorize geophysical operations on private lands in the project area.

3. Access to the project area is via state highways, existing county and private roads, existing two-track trails, or the public airspace.

4. The selected alternative will not result in any undue or unnecessary environmental degradation.

5. The selected alternative will help meet the nation's energy needs, and help stimulate local economies by maintaining workforce stability.

6. The Operator committed to:
   - Comply with all applicable federal, state, and local laws and regulations.
   - The operator incorporated several measures to alleviate resource impacts into their plan of action that they submitted.

7. The Operator certified it has a surface access agreement with the landowner(s).

8. The project is clearly lacking in wilderness characteristics as it is in the middle of gas development and its infrastructure.

9. APC, DG, and its helicopter operating agent assumes the responsibility for conducting a survey of pre-operations hazards to low-level flight for flight hazards attached to or on the BLM surface in the PR2SS area (wires, towers, guywires, blowing debris, etc.) prior to beginning geophysical survey. APC, DG, or its helicopter operating agent will maintain and update their hazards survey/map/file/document throughout the geophysical survey.

Mitigation Measures:
BLM Site Specific Conditions of Approval
Wildlife:

1. No entry will be allowed in the Fortification Creek management area big game crucial range from November 15 through April 30 (winter); and May 1 – June 30 (parturition).

2. No surface disturbing activities are permitted within 2 miles of known sage-grouse leks, or within the boundaries of designated core/connectivity between March 1 and June 15, prior to completion of a greater sage-grouse lek survey.

3. No surface disturbing activity shall occur within ½-mile of all identified raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season.

Cultural:

1. All identified cultural sites in the project area shall be avoided by at least 30 meters (100 ft.) by all geophysical operations.

BLM standard terms and conditions apply. For further details refer to the PR2SS COAs.

ADMINISTRATIVE REVIEW AND APPEAL: This decision is subject to administrative review according to 43 CFR 3165. Request for administrative review of this decision must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this Decision Record is received or considered to have been received. Any party who is adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Authorizing Official: Cory Finn Date: 9/7/11

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FINDING OF NO SIGNIFICANT IMPACT
Anadarko Petroleum Company, Powder River 2D Seismic Survey
Environmental Assessment (EA), WY-070-EA11-343
Buffalo Field Office, Bureau of Land Management

FINDING OF NO SIGNIFICANT IMPACT (FONSI): Based on the information in the EA, WY-070-EA11-343, which is incorporated here by reference; I find that: (1) the implementation of Alternative B will not have significant environmental impacts beyond those already addressed in the Buffalo Final Environmental Impact Statement (FEIS) 1985, and the Powder River Basin (PRB) FEIS, 2003, to which the EA tiers; (2) Alternative B conforms to the Buffalo Field Office (BFO) Resource Management Plan (RMP) (1985, 2001, 2003, 2011); and (3) Alternative B does not constitute a major federal action having a significant effect on the human environment. Thus an EIS is not required. I base this finding on my consideration of the Council on Environmental Quality's (CEQ) criteria for significance (40 CFR 1508.27), both with regard to the context and to the intensity of the impacts described in the EA, and in consideration of Interior Department Order 3310.

CONTEXT: Mineral development is a long-standing and common land use in the PRB. Over 42% of the nation's coal comes from the PRB. The PRB FEIS reasonably foreseeable development predicted and analyzed the development of 51,000 CBNG wells and 3,200 oil wells. The additional exploration described in Alternative B is insignificant in the national, regional, and local context.

INTENSITY: The implementation of Alternative B will result in beneficial effects in the forms of energy knowledge however; there will also be adverse effects to the environment. Design features and mitigation measures included in Alternative B will minimize adverse environmental effects. The preferred alternative does not pose a significant risk to public health and safety. The geographic area of project does not contain unique characteristics identified within the 1985 RMP, 2003 PRB FEIS, or other legislative or regulatory processes.

BLM used relevant scientific literature and professional expertise in preparing the EA. The scientific community is reasonably consistent with their conclusions on environmental effects relative to oil and gas exploration. Research findings on the nature of the environmental effects are not highly controversial, highly uncertain, or involve unique or unknown risks. The PRB FEIS predicted and analyzed gas exploration of the nature proposed with this project and similar projects. The selected alternative does not establish a precedent for future actions with significant effects. There are no cultural or historical resources present that will be adversely affected by the selected alternative. The project area is clearly lacking in wilderness characteristics as it is in the middle of gas development and its infrastructure.

No species listed under the Endangered Species Act or their designated critical habitat will be adversely affected. The selected alternative will not have any anticipated effects that would threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment.

ADMINISTRATIVE REVIEW AND APPEAL: This finding is subject to administrative review according to 43 CFR 3165. Request for administrative review of this finding must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this FONSI is received or considered to have been received. Any party who is adversely affected by the State Director's finding may appeal that finding to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Field Manager: _____ Date: 9/7/11

ENVIRONMENTAL ASSESSMENT (EA), WY-070-EA-343
Anadarko Petroleum Company, Powder River 2D Seismic Survey
Johnson & Campbell County, Wyoming
Bureau of Land Management, Buffalo Field Office

1. INTRODUCTION

- *Section 1 - Introduction:* This section includes a brief description of the applicant's proposal, scope of the analysis, information on the history of the project proposal and the purpose of and need for the project. This section identifies key issues that focus the analysis.

- *Section 2 - Description of the Alternatives:* This section provides a more detailed description of the applicant's proposal and the agency's proposed action, as well as alternatives. These alternatives were developed based on issues raised by the public and other agencies.

- *Section 3 - Affected Environment, Impacts, and Mitigation Measures Pertaining to Critical Resources:* This section describes the physical and regulatory environment of the area considered for the project. This analysis is organized by resource, e.g., vegetation, wildlife, recreation, etc. In each section, the affected environment is described first to provide a baseline for evaluation and comparison of the other alternatives that follow. This section of the EA also presents mitigation measures developed in response to the anticipated impacts, which would be applied to the project, if approved.

- *Section 4 – Affected Environment, Impacts, and Mitigation Measures Pertaining to Non-Critical Resources:* This section includes the same information as Section 3, but addresses non-critical resources in the project area.

- *Section 5- Consultation and Coordination:* This section contains a list of agencies or persons consulted during the preparation of the EA, followed by the sources cited in the EA.

- *Appendices:* The appendices contain a Notice of Intent (NOI) (Appendix A), Threatened, Endangered, Proposed, and Candidate Species Worksheet (Appendix B). Reclamation Requirements, WY BLM (Appendix C), Overall Project Map (Appendix D) and General Overview (Appendix E).

Additional information supporting the analysis presented in this document is in the project file located at the Bureau of Land Management (BLM) Buffalo Field Office (BFO).

1.1. Proposed Action Type, Location and Background

Dawson Geophysical (DG) proposes to conduct an exploratory, two-dimensional (2D), geophysical seismic survey of the Powder River 2D Seismic Survey (PR2SS) project area on behalf of Anadarko Petroleum Corporation (APC). The proposed project area is approximately 89 miles long in size and occupies portions of townships 46, 47, 48, 49, 50, 51, 52, 53, 54 & 55 North and Range 74, 75, 76, 77, 78, 79 & 80, West in Sheridan, Johnson & Campbell County, Wyoming. The proposed seismic survey would facilitate development of a 2D image of the geologic structure and stratagraphy underlying the project area. DG will also schedule a per-work meeting with the Buffalo Field Office (BFO) before recording operations commence on this 2D project.

This survey involves approximately (**25.08 miles**) administered by the BLM (**3.29 miles**) administered lands by the State of Wyoming and (**60.63 miles**) in private ownership. Entry on state lands is coordinated through the Wyoming State Land office. Separate applications are required for the activities on federal lands and this EA therefore pertains only to BLM lands.

The exploratory, seismic survey would involve the generation of ground vibration by detonation of explosives placed underground and recording of reflected sound waves patterns arising from the different underground geologic strata.

Legal descriptions of lands affected by the proposed project regardless of surface ownership are included below in Table 1:

Dawson Geophysical has made some changes to the legal descriptions that are on the NOI because of line movements and surface access. Please note the sections that say "ALL" are because we may need access in the 2D area, but we will not know until the surveyors get on the ground.
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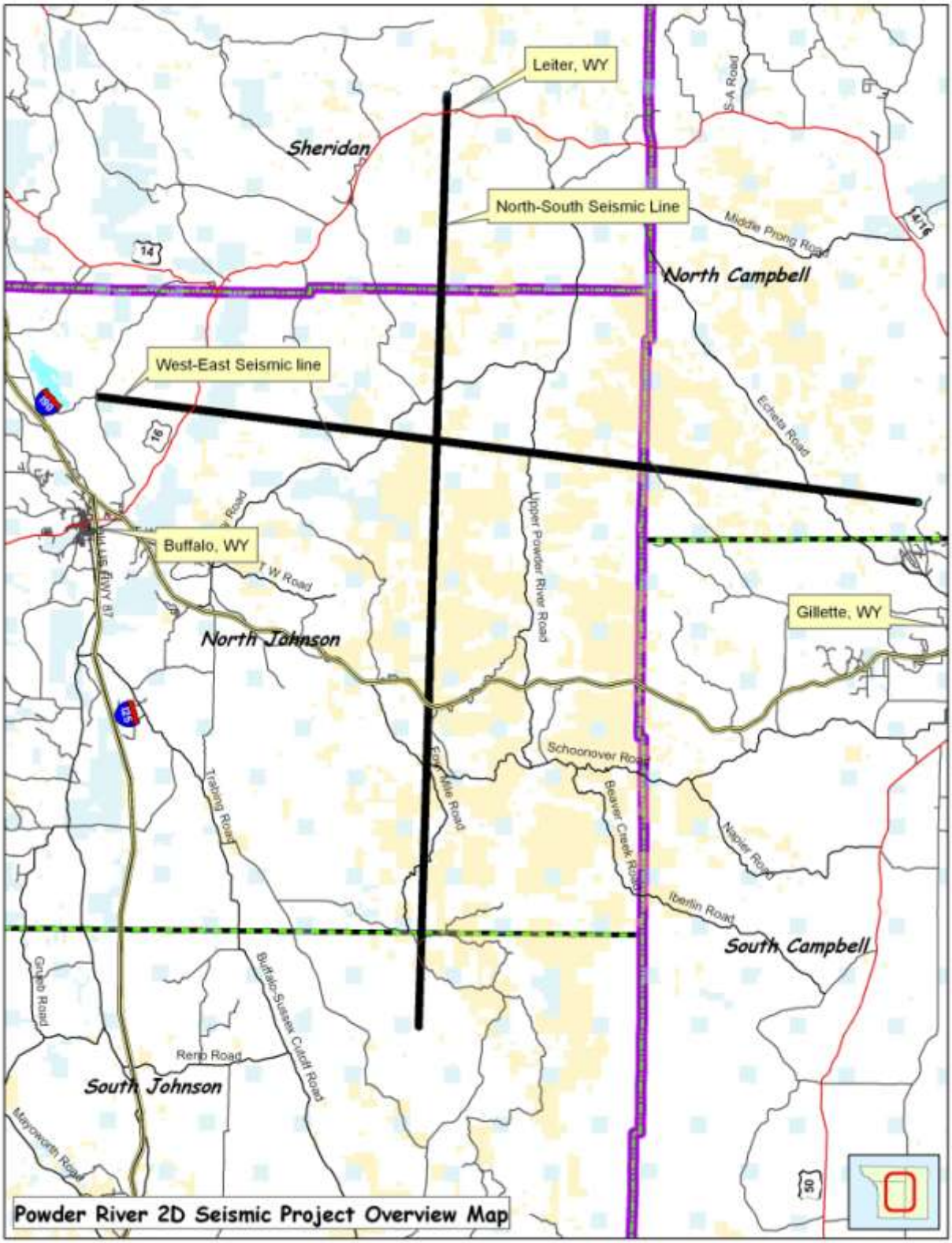
Figure 1.1. Powder River 2D Seismic Project Map



1.2. Background

DG proposes to conduct an exploratory, two-dimensional (2D), geophysical seismic survey of the PR2SS project area on behalf of APC. APC submitted the initial NOI to BLM on January 27, 2011.

- February 3, 2011: Met with proponent and discussed the NOI, gave the proponent a project deficiency letter on February 3, 2011.
- February 7, 2011: The proponent requested a variance for exceptions to big game, raptors, and sage-grouse winter range restrictions. BLM denied the variance. On the same date the proponent submitted an additional updated NOI.
- February 22, 2011: An updated project deficiency letter was sent to the proponent based on their most recent submittal of the February 7, 2011 NOI (see Appendix A of this EA, NOI).
- May 12, 2011: Met with operator and discussed project deficiencies and information needed to process the proponent's proposal, awaiting cultural report. It was also discussed that the proponent would start operations after all wildlife stipulations were over.
- May 26, 2011: The Wyoming Game and Fish Department (WGFD) commented and reviewed the proponents draft plan of action (POA) for the PR2SS.
- June 16, 2011: Asked proponent the status of the project via e-mail and timeframe.
- July 22, 2011: The U.S. Fish and Wildlife Service (USFWS) commented and reviewed the proponents draft POA for the PR2SS.
- August 9, 2011: Met with proponent to discuss the final revisions, updated project information, and discussed project time lines.
- August 11, 2011: The proponent re-submitted a new NOI and POA.

1.3. Conformance with Land Use Plans

The proposed action conforms to the terms and the conditions of the 1985 Buffalo RMP, the 2001 Approved RMP, the 2003 PRB FEIS, and the PRB FEIS ROD and RMP Amendments 2003, 2011 as required by 43 CFR 1610.5. BFO reviewed the plans and decisions, and a determined that this proposal conforms to land use plan decisions, guidelines, terms, and conditions as required by Federal Land Policy and Management Act (FLPMA), 43 CFR 1600, Interior Department Order 3310.

1.4. Relationship to Statutes and Regulations

BLM prepared this EA according to the National Environmental Policy Act (NEPA) and other statutes and regulations applicable to the project. BLM considered impacts to the entire proposed area, including state and private lands; however, BLM's authority for imposing mitigation standards, including conditions of approval (COAs) of the NOI for geophysical activity, pertain only to the public lands. FLPMA specifies that BLM manage public lands in a manner that recognizes the need for a domestic source of minerals and declares congressional policy that BLM manage federal lands for multiple uses.

Authority for geophysical prospecting on BLM-administered public lands is in the Mineral Leasing Act, Title 30 Chapter 3A, as amended, and the Code of Federal Regulations, 43 CFR 3150. Other relevant guidance includes BLM Manual 3150-Onshore Oil and Gas Geophysical Exploration Surface Management Requirements Manual. BLM completed processing this oil and gas exploratory application as an EA to save time and did not use the rebuttable presumption in the 2005 Energy Policy Act to process the application via a categorical exclusion. This EA's initiation pre-dated the 12 August 2011 decision by the Federal District Court of Wyoming and the exploratory activities may include low-level helicopter flights, probable explosions, and traipsing over 3 counties and multiple landowners – items of which the landowning and general public will find of interest. BLM will post the EA on its website and will release news announcements at the time of the proposed activity.

1.5. Need for Proposed Action

The proposed action, the PR2SS is needed to effectively evaluate hydrocarbon reserves underlying the project area for knowledgeable development of oil and gas resources. The 2D survey will provide a high-

resolution image of subsurface geological features underlying the project area. This proposed 2D seismic project is designed to accurately map structure, stratigraphy, rock, and fluid properties in the subsurface, which should enable wells to be drilled with a much greater probability of tapping producible hydrocarbons than is attainable without 2D geophysical exploration. The completion of the project should result in the drilling of fewer 'dry holes' in the future, minimizing the occurrence of abandoned well pads, as well as reducing the need for drilling and associated environmental disturbance.

1.6. Scoping and Public Involvement

BLM did not conduct external scoping for this EA. BLM conducted extensive external scoping for the Powder River Basin Environmental Impact Statement (PRB FEIS) and for the Fortification Creek Plan Amendment EA.

The BLM interdisciplinary team (ID team) conducted internal scoping by reviewing the proposed development and project location to identify potentially affected resource and land uses. Appendix B identifies those resources and land uses present and affected by the proposed action; those resources and land uses that are either not present, not affected, or were adequately covered by the PRB FEIS will not be discussed in this EA. The ID team identified significant issues for the affected resources to further focus the analysis. This EA addresses those site-specific impacts that were unknown at the time of the PRB FEIS analysis that would help in making a reasoned decision or may be related to a potentially significant effect. Issues for this project include:

- Soils and vegetation: site stability, reclamation potential, riparian and wetland communities, invasive species
- Wildlife: raptor productivity, greater sage-grouse lek occupancy and persistency
- Cultural: 48JO2982
- Social and Economic: revenue potential, local economics.

Items that did not rise to issues for analysis in this EA include:

- Air quality
- Fires and fuel management

2. DESCRIPTION OF THE ALTERNATIVES

This section describes and compares the alternatives considered for the PR2SS. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options.

2.1. No Action (Alternative A)

Under the No Action alternative, the seismic project would not be authorized on BLM-administered lands, which comprise 28% of the PR2SS area. Operations could only occur on state and private lands comprising of 4% of state lands and 68% of private lands for a total of the 72% of the project area. Existing land and resource use activities in the project area would continue generally as is. The Affected Environment descriptions presented in this EA, thus, also constitute the effects of the No Action alternative, unless otherwise noted.

2.2. Operator Proposed Action (Alternative B)

Scope of Work

The proposed seismic lines are positioned in an East-West direction for line 1 and a North-South direction for line 2. The receivers are 82.5 feet apart with in line sources points every 330 feet. The recording of seismic information would involve a total of approximately 6,848 receivers (geophones) stations lay out along both lines.

The project will start on the East side of the East/West line first to avoid winter range.

Methods of generating ground vibration will be done by setting off each shot point one at a time along the entire length of the 2D lines. Drilling of holes (shot holes) by off-road, buggy-mounted drills will account for all 1714 shot points of which only 440 will be located on BLM lands. The data generated from this study will evaluate hydrocarbon potential in the area without exploration drilling and prove resources available for extraction.

To accurately define the extent and locations of project activities, a land survey crew will locate and place temporary pin flags at receiver and source points using a high-accuracy global positioning system (GPS). A seven person crew will establish and flag the receiver and source point locations and travel routes between them. The survey crew will be responsible for positioning receiver every 82.5 feet and source point stations every 330 feet apart such that they avoid all known and apparent cultural, natural, and existing land use features of importance.

Archaeologists will identify potential sites or areas of concern for cultural resources from the Class III files search so DG can avoid all known sites during our seismic operations on the PR2SS project. This will cover any areas that would be affected by disturbance from implementing the seismic survey (source points and overland access routes for vehicles). Identified sites/areas of potential concern for cultural resources will be flagged for potential avoidance according to approved criteria. All results from the archaeology Class III files search will be provided to the land surveyors and, where necessary, means of avoidance for these archaeological resources will be determined, and the lines will be relocated to avoid that area. The areas will be free of snow cover before archaeological professionals begin assessments. The cultural resource inventory will cover an area of 50 ft wide on both side of the proposed 2D seismic line. All knows site on private surface will be avoided with the exception of foot traffic for placement of cable and geophones. On the BLM casual use area we will walk and there will be no shot holes.

The following sections provide additional details regarding project activities:

Explosives Detonation

DG will use the detonation of explosives set in the drilled shot holes to create the seismic-energy source points for this seismic survey project. Each hole will be 80 feet deep with a 20# charge placed in the bottom of the hole. We will be using buggy mounted or portable drills to create the shot holes. The reason for shot holes is because the terrain is too rough for vibrators to get around the area of operations. The buggy drills would travel off road and follow the path for the source line as modified by archaeological and biological surveys and obstacles. No clearing or grading by heavy equipment of routes for the off-road drilling program would be conducted. In some instances, tree limbs **may** be removed to allow passage of drill buggies and to prevent additional damage to the affected tree. Vegetation beneath the tires would be compressed; perennial grasses and herbaceous species would be flattened but would typically recover in the current or next growing season. More woody species, such as sagebrush, may be damaged, particularly the older, more brittle stems, but the younger more flexible parts of the plant would likely bend under the pressure and typically recover in the current or next growing season. Where possible, the buggy drills would proceed from one source location to the next with a single pass per source line. The buggy drills would traverse the entire seismic line where possible to complete the drilling of the inline shot holes. Existing roads and trails would be used where possible to access the next area to be drilled along the seismic line. Each 4-wheel-drive drill-buggy vehicle (low pressure-tired, articulated, off-road transport vehicles with mounted drill) would weigh about 28,000 pounds, and each low-pressure tire would be approximately three feet wide. Total buggy width is approximately 10 feet with 2, 3-foot wide tire treads. To account for maneuvering flexibility to avoid obstacles or sensitive resources, travel distance between lines, and multiple passes, it is estimated that buggies would travel no more than approximately 1.5 miles for every mile of buggy drilled source points. Exceptions to traveling the entire

seismic line would include altered routes to avoid environmentally sensitive areas (cultural resources, sensitive biological conditions, etc.) or other obstacles. Buggy tires would not be chained. The large, low-pressure tires of a buggy drill would exert a pressure of about eight psi on the surface.

After placing the shot in a shot hole, a shot hole-plug would be placed in the hole as specified by the State of Wyoming Oil and Gas Commission regulations for seismic exploration. Providing that no water is encountered while drilling, the hole would be back-filled with drill cuttings to within 3 feet of the surface and a nonmetallic plug would be installed in the hole. The remaining 3 feet would be backfilled to the surface and covered with more drill cuttings and soil. Excess drill cuttings would be mixed with soil and spread over the surrounding area. In the event that water is encountered during drilling, the appropriate procedures would be followed.

The shots would be detonated individually in the shot pattern determined appropriate for those geologic conditions along each 2D line. Detonation would typically produce a small plume of dust within a few feet of the shot hole. Shot points would be triggered from a central control truck stationed on an existing road/trail and a safety officer stationed at a position with line-of-sight visibility, but at a minimum safe distance. The safety officer ultimately controls the detonation and allows detonations initiated by the control trailer (telemetric signal) only if observations indicate the absence of people and animals near the shot hole.

Should the detonated explosive blow the plug and the drill cuttings out of the hole (a blowout), whatever limited disturbance to the surface would be repaired as part of line restoration/reclamation including re-plugging and replacing the hole packing materials with drill cuttings and soil materials that were expelled by the blast from the hole. Based on experience in similar geologic settings, blowouts are unlikely.

For source locations located near drainages, the locations have been shifted far enough up and out of the respective drainage and floodplain in order to avoid these issues. Proposed offset distances that will be utilized on the project. Shot holes can sit in underground for several years with no problems to the ground, animals, or people.

These distances are as follows:

- Buildings – Occupied buildings 300-400 ft. shot point.
- Unoccupied/historic building as per cultural/natural features described below.
- Pipelines – 140 to 350 ft., with further exception as granted based on permission of owner. All operators in the project will be contacted and DG warrants the landowners agreed to DG'S proposed setback distances.
- Water Wells – 300 ft. shot points
- Springs – 300 ft shot points

Cultural features not sensitive to vibrations, such as lithic scatter, shall be avoided by a nominal buffer established by the BLM, as well as the research archeologist.

Disturbance Estimates

Short-term surface disturbance as a direct result of the seismic survey operations including drill buggy passage to source locations and receiver line traffic areas, total approximately **35.75 acres** along the **25 miles** of line estimated on BLM properties in the project area. Disturbance consists of the following: in some instances, tree limbs **may** be removed to allow passage of drill buggies and to prevent additional damage to the affected tree. Vegetation beneath the tires would be compressed; perennial grasses and herbaceous species would be flattened but would typically recover in the current or next growing season. More woody species, such as sagebrush, may be damaged, particularly the older, more brittle stems, but

the younger more flexible parts of the plant would likely bend under the pressure and typically recover in the current or next growing season.

Data Acquisition
Recording equipment would be transported to the field and staging areas (includes helicopter landing zones) by truck using existing roads and trails. Sufficient equipment to lay out 6 sets of geophones, one length of seismic cable, and appropriate battery and field recording boxes would be placed in reinforced nylon cache bags at helicopter landing sites and flown to the pre-determined, flagged locations for stations along each receiver line. One helicopter would be used for the project, and would operate only in daylight hours ferrying the receiving-station cache bags to preset locations. The helicopter would move 6 to 8 cache bags at a time suspended from a long line (external load). The helicopter would operate at an altitude of approximately 50-75 feet above the receiver line and deposit one bag at a time using GPS pin flag locations provided by the surveyors. Ground crew members would walk to the first dropped cache bag on their receiver line, prepares the radio-telemetric station, and manually connect cables and geophones. Seismic cable and attached geophones would be laid out by hand around each station in a pre-determined pattern. The geophones mounted on a 4-inch spike would be placed into the soil using foot pressure. The crew member would then proceed on foot to the second bag and repeat the set-up of the first station (receiver location) and its network of cable and geophones. Stations, cable, and geophones would be laid out in this manner at each station along the project area. After recording in an "active" area of receiver lines, geophones, cable, and each station's equipment would be retrieved on foot and bagged using a procedure reverse of placement and moved to a new receiver location by helicopter.

Approximately 40 to 50 crew members would conduct daily operations for 10 to 12 hours per day. Crew members would be organized into field groups of 4 to 6 personnel; groups would operate at intervals of 1 to 2 miles throughout the project area. A troubleshooting crew of 4 to 6 people would repair electrical problems during the project operations, and gather data recorded in the field boxes. Crew members would carpool daily to the project area in the morning and return to surrounding cities/towns in the evening.

The recording control truck containing the data collection equipment would be on an existing road or trail or previously archaeologically cleared place to initiate the source detonation for the active receiver site locations during the shot detonations.

Demobilization
The demobilization task would proceed concurrently with data acquisition. All pin flags, flagging, and other "trash" would be gathered daily as the field groups and crew members complete data-acquisition portions of the project. The "trash" would be collected at points on roads or trails and transported by vehicle to staging areas where personnel would organize materials, handle equipment, and dispose of used/unusable materials. This task would be completed within about 3 days after conclusion of the data acquisition.

Support Operations
All equipment, including the drills would be initially brought to the project area by 12 to 20 transport trucks/tractor trailers as part of project mobilization. Operation of most support vehicles, including pickups, would be limited to existing roads and trails or to routes/areas surveyed and cleared previously for archaeological resources. The staging areas and recording trucks will park on private property on this project.

The helicopter may also land on existing road, approved source routes and trail intersections, existing well pads, and staging areas/landing zones within the PR2SS project area to pick up or drop off equipment or personnel. There will be no staging areas or new roads, routes, or trails constructed, cut, or created through use on BLM property. The helicopter that will be used is a Lama - 315B. The fueling of

the helicopter we will be fueling on private land only. For the spill prevention the operator will have a double wall system on both the chopper and the fuel truck.

Project Activities and Schedule

Seismic survey activities would proceed systematically from east to west and north to south along the project area. If we have any seasonal restriction DG will try start in that area. Specific activities in order of occurrence would include:

1) The drilling of shot holes and placement of explosives generally from east to west or north to south along the prospect area. Drilling activity may proceed for a few weeks to a month before other subsequent activities would commence.
2) Placement of 6,848 sets of geophones will be placed along the entire 2D lines as needed for recording the given spread set forth by the client.
3) Controlled detonation of explosive shots and recording would begin shortly after placement of the initial grouping of receiver stations/geophones. After all source generation is completed along the receiver lines in that given area, the receivers would be picked up and moved ahead ("leap-frog") and laid out to form the new leading edge of the receivers prior to re-initiating source generation.
4) Source generation and recording is expected to be completed within 30 days for the recording crew. The duration of the complete survey is projected to be about 90 to 120 days, including (permitting, surveying, drilling & recording) mobilization and demobilization. This time period will run concurrently with activities on other projects located in the same vicinity.
5) Activities would commence as soon as the appropriate permits are in place for the project.

Applicant Committed Environmental Protection Measures

The specific environmental protection or mitigation measures listed below by activity or environmental resource area would be incorporated into the applicant's proposed action as integral components of the proposed project.

Fire Protection

- Off-road equipment, buggy drills, would be diesel powered (no catalytic converter).
- All ground vehicles would be equipped with fire extinguishers and shovels.
- Helicopter landing zones at staging areas would be equipped with fire extinguishers.

The following operational procedures would be followed:

- All brush build-up around mufflers, radiators, headers, and other engine parts would be avoided; periodic checks would be conducted to prevent this build-up.
- Smoking would only be allowed in company vehicles and/or designated smoking areas; all cigarette butts would be placed in appropriate containers and not thrown on the ground or out windows of vehicles.
- Cooking, campfires, or fires of any kind would not be allowed while working in designated high-hazard fire areas.
- Portable generators used in the project area would be required to have spark arresters.
- DG would coordinate project activities with appropriate fire-fighting personnel in the BFO. The crew contingency plan would include a fire communications protocol for contacting fire-fighting personnel.

Existing Facilities/ROWs Protection

- Safe operating distances (based on accepted industry standards) would be maintained between shot holes and existing facilities including producing oil and gas wells, pipelines, electrical utility lines, and around helicopter field landing or staging areas.
- Gates would be used for crossing fences whenever possible. If however, a fence crossing is required

for a location absent a gate, the fence could be let down to create a temporary opening. Upon termination of seismic survey activities, the temporary opening would be permanently rewired and stretched to their original tension.
- Any facilities impacted by the proposed seismic survey would be repaired or replaced as soon as practical before the end of the project.

Hazardous and Solid Waste/Trash Disposal
- Fuel and lubricants would be temporarily stored in transportable containment-trailers at locations approved by the appropriate surface management agency in staging areas to minimize potential for accidental releases/spills. No other hazardous or potentially hazardous materials would be brought into the project area.
- All spills or leaks of fuel, hydraulic fluid, lubricating oil, and coolant, including contaminated soil material, would be excavated to an appropriate container and transported to an approved disposal site.
- All solid waste or trash would be transported for disposal to an approved solid waste disposal facility.

Public/Crew Safety
- Vehicles would travel at speeds within set speed limits of main access roads and at slower speeds appropriate for conditions on more remote roads and trails.
- Signs warning the public of seismic survey activity would be located at the closest road/trail intersections on either side of the next day's planned activity.
- Drilling crew/staff would keep the public a safe distance away from all buggy drill and helicopter field landing or staging activity.
- All survey crew members would wear safety vests, hardhats, and goggles where required.
- The shot hole detonation observer would wear a hardhat and safety goggles.
- Prior to detonation, the shot hole observer would release 3 blasts from an air horn to warn any crew members or public of an impending detonation. A hand-held device operated by the observer would be used to interrupt detonation if an unsafe condition exists.
- The helicopter will follow flight paths chosen to be efficient while following activity-specific aviation operational safety standards for flight altitudes per Federal Aviation Administration (FAA) rules, 14 CFR et seq., the Federal Aviation Regulations (FARs).
  - The helicopter and its crew will have certifications that include but are not limited to FAR Part 133, Rotorcraft External Load Operations, in the appropriate class.
  - The helicopter refueling and servicing will occur at staging areas and may occur at airports.
  - Helicopters' inherent nature and the FARs permit flying in airspace down to but not including the earth's surface. Here on designated survey lands the helicopter, like the buggies, may have contact with the survey lands. Yet the helicopter should avoid low level overflights of towns, hospitals, ranch buildings, livestock, and wildlife (to preclude contributing to stampeding over cliffs or through fences).
  - The public should direct questions about helicopter operations to the BFO, alternatively to APC, or DG, or the FAA Flight Standards District Office, 951 Werner Court, Casper, WY, 82651, 800-325-5785.
- Explosives and detonator caps would be stored in or near the project area in large, secure magazines (large locked steel boxes) per Federal Bureau of Alcohol, Tobacco, and Firearms requirements. Signage for the magazines would not be placed on the magazines, but on adjacent posts or other permanent features.
- Explosives/detonators would be transported in accordance with Federal Department of Transportation regulations.

Water Resources, Wetland/Riparian/Floodplain Protection

- Should saturated conditions or water in a drilled shot hole be encountered, native bentonite would be packed into the shot hole to above the water level in the hole to seal the saturated zone.
- Project water would be obtained from adjudicated commercial sources.
- No shot holes would be drilled within 100 feet of perennial surface water features.
- No wetland/riparian vegetation would be removed during the placement of geophones. Helicopters would be used to place equipment to support placement of recording lines to reduce surface disturbance.
- No operations other than receiver placement would be performed within 200 feet or a greater distance as per the BLM of a spring.

Soil Resource Protection

- No cross-country travel would be permitted on slopes greater than approximately 25% by drill buggies. Heliportable drills will be used on slopes great then 25%
- No vehicles would be operated during periods of saturated soil conditions when surface ruts greater than 4 inches would occur along straight travel routes.
- Buggy drills traffic would be planned to minimize the number of passes over the same ground, and to minimize the potential for soil compaction and for impacts to biological soil crusts.
- Vehicles would be instructed to travel at slow speeds to limit disturbance to soils and vegetation.
- The spinning of all vehicle tires would be avoided where possible to minimize the potential for soil displacement.

Vegetation Resources Protection

- All equipment, including on-road and off-road equipment, would be cleaned to remove weed seed and soil (may contain weed seed) prior to commencing operations.
- Larger shrubs, trees, and other obstacles would be avoided where possible; no cutting or removal of shrubs, trees, or other obstacles is proposed.

Wildlife Resources

- DG would comply with wildlife protection measures.
- Project activities would be conducted in compliance with applicable requirements of the Endangered Species Act of 1973, as amended.
- Project personnel would be subject to the following requirements: no harassing or shooting of wildlife or wild horses; no dogs may be brought to the project area; no firearms permitted; and no littering.

Livestock Grazing

- All gates within the project area would be left as they are found (i.e., open gates would be left open, closed gates would be closed).
- Damage to existing fences and other range improvements as a result of the seismic survey would be immediately repaired.
- Removal or alteration of existing range improvements would be prohibited unless prior approval from the appropriate BLM is obtained.
- DG personnel will be instructed to minimize contact and avoid harassment of livestock and wildlife.

Cultural Resources

- Permitted archaeologists would conduct a Class III survey for cultural resources of all areas to be disturbed by source generation activities including source access routes, geophones lines and staging areas. All cultural sites identified in the Class III cultural resources field survey would be flagged for avoidance from source generation activities. Permitted archaeologists would also be responsible for

assisting with protection, identification, and assessment of any cultural resources by flagging the area to be avoided.

- If surface / subsurface cultural resources were found during project operations, all work in the immediate vicinity of the resource would cease and DG would notify the BFO immediately. DG would implement those measures requested by the appropriate BLM to protect the resource until a permitted archaeologist, if necessary could adequately evaluate it. Further work at the archaeological site would be discontinued.
- Prior to commencement of each task of operations, DG employee briefings would be conducted to inform personnel of critical elements of compliance with the Archaeological Resources Protection Act (ARPA) and the National Historic Preservation Act (NHPA).
- All DG employees and their contractors would be informed before commencement of operations that any disturbance to, defacement of, or removal of archaeological, historical, or sacred material would not be permitted. Violation of the laws that protect these resources would be treated as law enforcement/administrative issues.

2.3. Alternatives Considered But Eliminated From Detailed Analysis

A number of alternatives to the proposed action were considered. The following are brief descriptions of alternatives eliminated from detailed study and the reasons for eliminating them.

Exploratory Drilling

Exploratory drilling is an alternative to collecting and analyzing seismic data. Exploratory drilling was the only available method of locating oil and gas reserves prior to development of 2-D and 3-D seismic technologies used to image the subsurface geology of an area and pinpoint locations of potential reservoirs. Exploratory wells are typically less successful, more costly, and have greater environmental impacts (i.e., more wells and roads are required) than wells based on high quality seismic data, therefore, it was not considered to be a viable alternative for accomplishing project objectives.

Use Helicopter Operations for the Entire Project

Under this alternative a helicopter would transport portable drills to each source point location, and all layout, pickup and troubleshooting would be accomplished on foot with helicopter support, limiting the need for off-road vehicle travel. Heliportable drill units are small and lightweight, and have a lot less torque than larger, heavier drills. It is estimated that each heliportable unit would be capable of drilling approximately 4 to 6 holes per day based on the substrate present in the project area. Assuming that each drill can accomplish 4 holes a day, and the number of source points would remain the same, heliportable drilling would require approximately fourteen and a half months for completion. With seasonal wildlife and hunting period restrictions applicable to the project area, this method would not allow for continuous operations, and would therefore not be feasible, strictly from a time-frame standpoint. In addition to time constraints, the entire project area would be subject to constant helicopter traffic along seismic lines throughout the duration of the project, creating increased noise disturbance to wildlife and people in the area for an extensive period of time. The above-mentioned factors, combined with increased operating costs that would be many times that of the proposed action, make this option economically unfeasible and environmentally undesirable. It was eliminated from future analysis.

Use Passive Seismic for Survey

Passive seismic is a relatively new and unproven methodology for characterizing the subsurface with respect to oil and gas reservoir potential. This technique utilizes seismic receivers placed in the field in an array similar to conventional 3-D seismic technology, which record the naturally occurring seismic activity. This methodology does not require the need for man-made energy sources (i.e. dynamite, vibrators, or air guns). Receivers pick up energy released from micro-seismic events occurring deep within the earth's crust.

There are 3 significant reasons why this methodology was eliminated from analysis. First, the amount of time necessary to collect data with passive seismic technology is highly variable and dependent on the natural seismic processes within the earth's crust. These natural seismic events are also highly unpredictable in time and space. In some test examples using this method, it took up to a year to collect enough data to provide a high-resolution image necessary to map and pinpoint the location of hydrocarbon reservoirs. In areas with a low occurrence of natural seismic activity the process could take many years. In the oil and gas exploration industry today, there are time constraints set by regulatory and surface permits, as well as mineral lease agreements. In addition, increases in the amount of time necessary to conduct the survey intensify the longevity of impacts and disturbances to wildlife, recreationists, local residents, and natural resources.

Second, the equipment needed is relatively new and expensive, and few geophysical data collection companies are equipped with this new and unproven technology. The amount of time required to collect data can increase project costs through maintaining field crews for longer periods of time.

A third reason is there are still problems with the reliability of the data. Passive seismic technology has not undergone the testing necessary for users to have confidence in the data. It is difficult to spend large amounts of money on technology that has not been proven to work equally or better than conventional methods. For these reasons, the alternative was eliminated from analysis.

3. AFFECTED ENVIRONMENT, IMPACTS, AND MITIGATION MEASURES PERTAINING TO CRITICAL RESOURCES

This section provides an analysis of potential impacts (environmental effects), which would result from project implementation under each alternative. Note that the anticipated environmental consequences of the No Action alternative are largely the same as the Affected Environment description; therefore, they are addressed under the same heading unless otherwise noted. This section of the EA also presents mitigation measures developed in response to the anticipated impacts, which would be applied to the project, if approved. Critical elements of the human environment (identified by the BLM NEPA Handbook H-1790-1), their status in the project area, and whether or not they would be affected by the proposed project are discussed in the sections below:

3.1. Air Quality

3.1.1. Affected Environment

There are no special designation air sheds or non-attainment areas nearby that would be affected by the proposed action. Anticipated impact to air quality would occur from exhaust fumes emitted by drilling buggies, ATVs, a helicopter, drills and miscellaneous support vehicles. Emissions would be present throughout the duration of proposed field recording operations and be similar to that of 8 semi-trucks and 10 cars. Impacts resulting from exhaust emissions are expected to be negligible. Air quality would also be slightly altered by fugitive dust resulting from vehicle travel on existing roads and trails, and to a much lesser extent, dust from cross-country vehicular travel. Helicopters and ATVs, rather than jug trucks, would be used to transport cable and geophone equipment off road, thus minimizing dust creation. Off road ground vehicles would be restricted to speeds less than 15 mph. Fugitive dust contributions are expected to be minimal, short term, and localized.

3.2. Proposed Action (Alternative B)

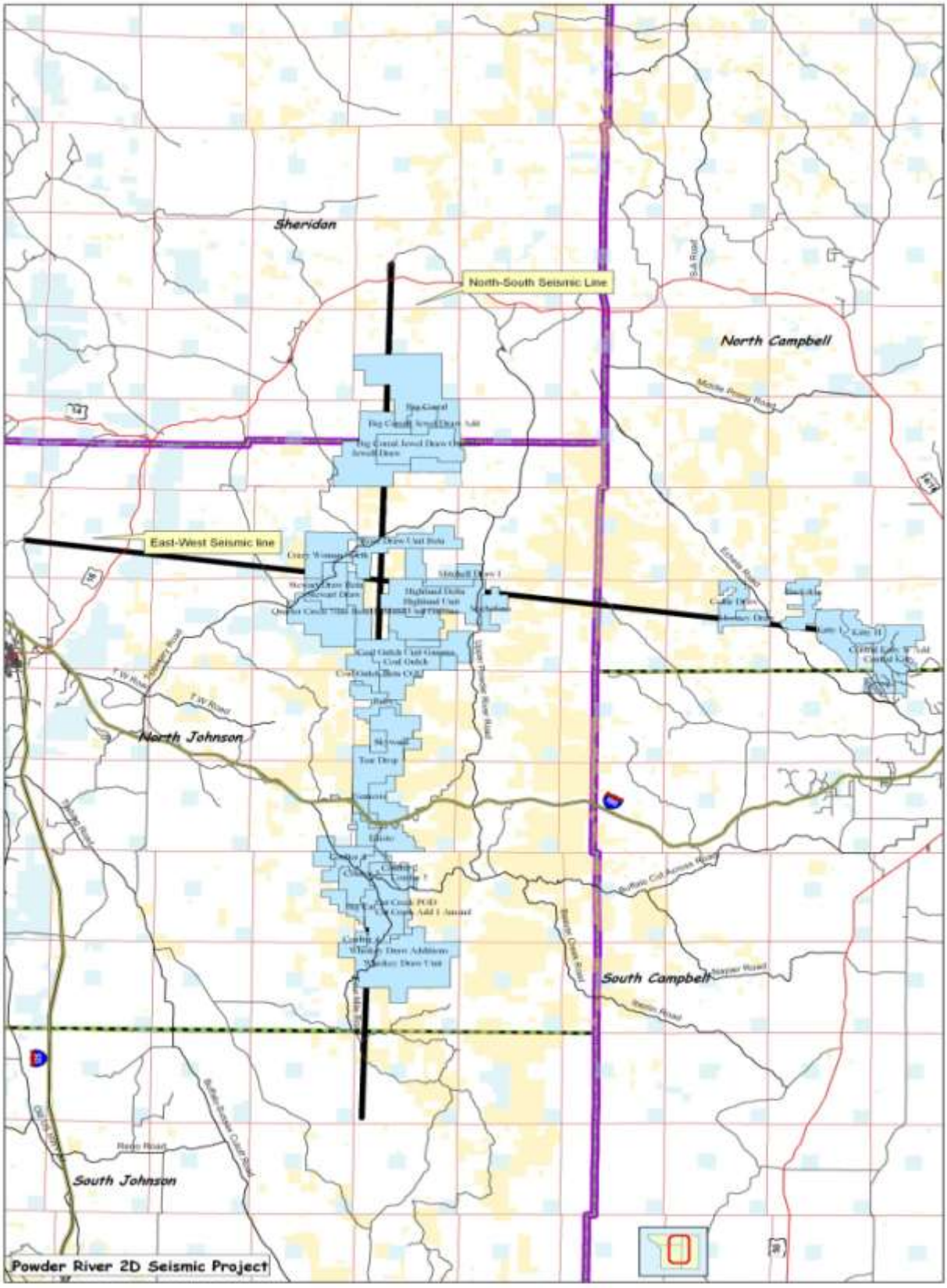
This section describes the environment affected by the implementation of the Alternatives described in Section 2. Aspects of the affected environment described here focus on the relevant major issues that were not raised in the earlier EA's. The proposed project area is in a highly developed coal bed natural gas (CBNG) fields. Thirty-eight (38) different oil and gas operators developed leases in the project area.

Table 3.1 lists existing NEPA documentation that analyzed and permitted wells and associated infrastructure in the project area which includes the sites for the proposed action.

Table 3.1. Approved EAs Overlapping the Powder River 2 Seismic Survey Area

	Approved POD	NEPA Document	Approval Date
1	Big Corral	WY-070-07-043	9/11/2006
2	Jewell Draw	WY-070-04-199	9/15/2006
3	Big Cat	WY-070-03-009	1/10/2003
4	Ruby	WY-070-04-264	9/27/2004
5	Whiskey Draw Unit	WY-070-04-201	7/21/2004
6	Coal Gulch	WY-070-04-161	7/30/2004
7	Highland Unit	WY-070-04-161	7/30/2004
8	Buckskin	WY-070-04-236	2/11/2005
9	Cedar Draw Additions POD	WY-070-05-136	2/25/2005
10	Nemesis	WY-070-05-157	9/13/2005
11	Skyward	WY-070-05-187	9/23/2005
12	Coulter 2	WY-070-05-224	7/20/2005
13	Mooney Draw	WY-070-06-316	9/29/2006
14	Whiskey Draw Additions	WY-070-05-261	9/15/2005
15	Michelena	WY-070-05-295	9/29/2006
16	Crazy Woman North	WY-070-05-401	2/17/2006
17	Mitchell Draw I	WY-070-06-069	4/4/2006
18	Big Corrall Jewel Draw Add	WY-070-06-156	4/14/2006
19	Coal Gulch Beta CGU	WY-070-06-246	9/22/2006
20	Cat Creek POD	WY-070-04-136	9/9/2004
21	Stewart Draw	WY-070-07-115	4/23/2007
22	Coulter 5	WY-070-07-123	9/7/2007
23	Edisto	WY-070-07-075	9/5/2007
24	Highland Unit Gamma	WY-070-07-195	9/28/2007
25	Cat Creek Add 1 Amend	CX 070-06-3-006 thru 009	9/6/2007
26	Quarter Circle Nine Beta	WY-070-08-055	8/4/2008
27	Big Corral Jewel Draw Gamma	WY-070-08-168	9/4/2008
28	Rose Draw Unit Beta	WY-070-08-186	9/25/2008
29	Tear Drop	WY-070-08-072	4/4/2008
30	Coulter 4	WY-070-08-169	9/18/2008
31	Coal Gulch Unit Gamma	CX-070-390CX3-11-64 thru 128	12/10/2010
32	Stewart Draw Beta	WY-070-09-159	1/8/2010
33	Highland Unit Delta	WY-070-10-383	9/29/2010
34	Cat Creek Add	CX 070-06-3-006 thru 009	6/30/2006
35	Central Kitty	WY-070-01-173	7/5/2001
36	Central Kitty Additional Wells	WY-070-02-025	12/3/2001
37	Kitty H	WY-070-01-217	9/4/2001
38	Kitty I	WY-070-02-007	10/18/2001

Figure 3.1. Approved CBNG PODs Overlapping the Powder River 2D Seismic Project



The following critical elements (subject to requirements specified in statute, regulation, or executive order) other than wildlife and cultural, received a "hard look" analysis under an earlier EA and are either not present, or are unaffected by the proposed PR2SS or the alternatives in this EA and are not subject to further analysis. This EA will analyze wildlife and cultural issues that are germane for this proposed action but were inapplicable in previous NEPA analysis.

Table 3.2. Affected Resources

Resource	Resource Present	Resource Affected	Table 3.1 EAs Sufficient	PRB FEIS Sufficient	Notes
Air quality	Yes	Yes	Yes	Yes	PRB FEIS: 3-291-298, 4-404-406, 4-377-386
Cultural	Yes	No	No	No	PRB FEIS: 3-206-228, 4-273-288, 4-394
Native American religious concerns	No	No		No	PRB FEIS: 3-218-219, 3-228, 4-277-278
Traditional Cultural Properties	No	No		No	PRB FEIS: 3-218-219, 4-277-278
Mineral Potential	Yes	No		Yes	PRB FEIS: 3-66-70, 3-230, 4-127-129
Coal	No				PRB FEIS: 3-66
Fluid Minerals	Yes				PRB FEIS: 3-68-69
Locatable Minerals	Yes	Yes	Yes	No	
Other Leasables	No	No		NA	
Salable Minerals	No	No		NA	
Paleontology	No				PRB FEIS: 3-65-66, 4-125-127
PFYC 3	Yes	Yes	No	Yes	PRB FEIS: 3-65-66, 4-125-127
PFYC 5	No				PRB FEIS: 3-65-66, 4-125-127
Rangeland management	Yes	Yes	Yes		Not in PRB FEIS
Existing range improvements	Yes	No			
Proposed range improvements	No	No			
Recreation	Yes	No	Yes	Yes	PRB FEIS: 3-263-273, 4-319-328
Developed site	No				PRB FEIS: 3-266, 4-326
Walk-in-Area	No				
Social & Economic	Yes	Yes	Yes	Yes	PRB FEIS: 3-275-289, 4-336-370
Soils & Vegetation	Yes	Yes	Yes	Yes	Addressed in EA. PRB FEIS: 3-78-107, 4-134-152, 4-

Resource	Resource Present	Resource Affected	Table 3.1 EAs Sufficient	PRB FEIS Sufficient	Notes
					153-164, 4-393-394, 4-406
Erosion Hazard	Yes	Yes	Yes	Yes	Addressed in EA. PRB FEIS: 3-82, 4-135
Poor Reclamation Potential	No				Addressed in EA. PRB FEIS: 3-86, 4-149-152
Slope hazard	No	No			Addressed in EA. PRB FEIS: 3-81, 4-135
Forest products	No				
Invasive Species	Yes	Yes	Yes	Yes	Addressed in EA. PRB FEIS: 3-103-108, 4-153-172
Wetlands/Riparian	No				PRB FEIS: 4-117 to 124 3-108-113, 4-172-178, 4-406
Special Designations	No				
Proposed ACEC	No				
Wild & Scenic River	No				PRB FEIS: 3-273
Wilderness Characteristics/Citizen Proposed	No	No	No	No	DOI Order 3310
WSA	No				DOI Order 3310
Visual Resources	No				PRB FEIS: 3-252-263, 4-302-314, 4-403
Class II	No				
Class III	No				
Water	No				PRB FEIS: 3-1-56, 4-1-122, 4-135, 4-33, 4-405
Floodplains	No				
Ground water	Yes	No			PRB FEIS: 3-1-30, 4-1-69, 4-392, 4-405
Surface water	No				PRB FEIS: 4-85 to 86, 4-117 to 124 3-36-56, 4-69-122, 4-393, 4-405
Drinking water	No				PRB FEIS: 3-52, 4-50-52
Wildlife	Yes	Yes	Yes	Yes	PRB FEIS: 3-113-170, 4-179-249, 4-397
ESA listed, proposed, or candidate species	Yes	Yes	No	No	PRB FEIS: 3-174-178, 4-251-255

Resource	Resource Present	Resource Affected	Table 3.1 EAs Sufficient	PRB FEIS Sufficient	Notes
BLM sensitive species	Yes	Yes	Yes	Yes	PRB FEIS: 3-189-206, 4-255-273
General wildlife	Yes	Yes	Yes	Yes	
West Nile virus potential	Yes	No	Yes		

3.3. Soils and Vegetation

Short-term surface disturbance as a direct result of the seismic survey operations including drill buggy passage to source locations and receiver line traffic areas. Disturbance consists of the following: In some instances, tree limbs **may** be removed to allow passage of drill buggies and to prevent additional damage to the affected tree. Vegetation beneath the tires would be compressed; perennial grasses and herbaceous species would be flattened but would typically recover in the current or next growing season. More woody species, such as sagebrush, may be damaged, particularly the older, more brittle stems, but the younger more flexible parts of the plant would likely bend under the pressure and typically recover in the current or next growing season.

Soil Resource Protection

- No cross-country travel would be permitted on slopes greater than approximately 25% by drill buggies. Heliportable drills will be used on slopes great then 25%.
- No vehicles would be operated during periods of saturated soil conditions when surface ruts greater than 4 inches would occur along straight travel routes.
- Buggy drills traffic would be planned to minimize the number of passes over the same ground, and to minimize the potential for soil compaction and for impacts to biological soil crusts.
- Vehicles would be instructed to travel at slow speeds to limit disturbance to soils and vegetation.
- The spinning of all vehicle tires would be avoided where possible to minimize the potential for soil displacement.

Vegetation Resources Protection

- All equipment, including on-road and off-road equipment, would be cleaned to remove weed seed and soil (may contain weed seed) prior to commencing operations.
- Larger shrubs, trees, and other obstacles would be avoided where possible; no cutting or removal of shrubs, trees, or other obstacles is proposed.

3.4. Wildlife

3.4.1. Affected Environment

The overall seismic survey project area includes habitat for a variety of birds and mammals including BLM sensitive, game and non-game species. Many of the species reside within the project area all year; however, some species are present seasonally.

3.4.2. Threatened, Endangered, and Candidate Species

3.4.2.1. Threatened

3.4.2.1.1. Ute Ladies' Tresses Orchid (ULT)

No populations of ULTs (*Spiranthes diluvialis*) are known to occur within the PR2SS area; however, populations have been documented in north-central Colorado and Wyoming (in Converse, Goshen, Laramie and Niobrara Counties). ULTs exist in seasonally moist to very wet meadows along streams or stream meanders that retain ample ground water in areas below 7,000 feet in elevation. It is also found to

occur near springs, seeps, or lakeshores. Suitable habitat for the species may be present along creek corridors within the project area.

3.4.2.2. Candidate Species

3.4.2.2.1. Greater Sage-Grouse

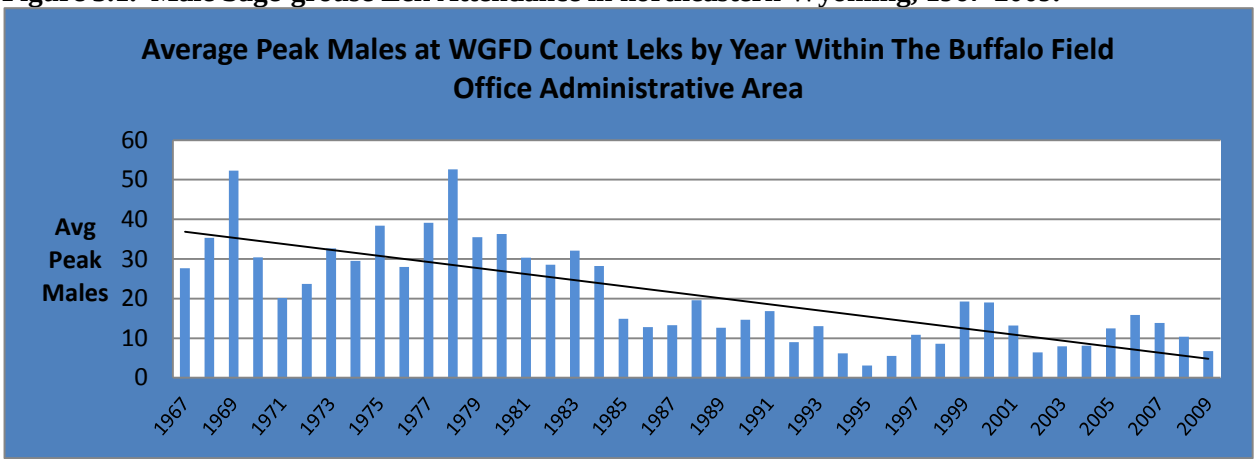
USFWS warranted but precluded for higher priorities, the sage-grouse for federal listing across its range in 2010. In addition to being a Wyoming BLM sensitive species, sage-grouse are a WGFD species of greatest conservation need, because populations are declining and they are experiencing ongoing habitat loss. The Wyoming Bird Conservation Plan rates them as a Level I species, indicating they are clearly in need of conservation action. USFWS also lists them as a BCC for Region 17.

Powder River Basin (PRB)

The PRB serves as a link between the Wyoming Basin and central Montana grouse populations. The PRB is in sage-grouse Management Zone 1, which is predominantly grasslands and approaches the periphery of sage-grouse distribution that extends into the Dakotas and southern Saskatchewan. In the PRB sagebrush is more heterogeneously distributed, and where found, is at lower densities (less canopy cover), than it is in other management zones. In the context of habitat structural quality within the PRB, the project area contains quality habitat.

The sage-grouse population in northeast Wyoming is exhibiting a steady long term downward trend, as measured by lek attendance (WGFD 2008b). The following figure illustrates a 10-year cycle of periodic highs and lows. Each subsequent population peak is lower than the previous peak. Research suggests that these declines may be a result, in part, of CBNG development in this region of Wyoming and that the leks in the project area are experiencing similar declines (USFWS 2010).

Figure 3.1. Male Sage-grouse Lek Attendance in northeastern Wyoming, 1967-2009.



Research shows that declines in lek attendance are correlated with oil and gas development. In a typical landscape in the PRB, energy development within 2 miles of leks is projected to reduce the average probability of lek persistence from 87% to 5% (Walker et al. 2007). Several studies show that well density is useful as a metric for evaluating impacts to sage-grouse, as measured by declines in lek attendance (Braun et al. 2002, Holloran et al. 2005, and Walker et al. 2007). These studies indicate that oil or gas development exceeding approximately 1 well pad per square mile, resulted in calculable impacts on breeding populations, as measured by the number of male sage-grouse attending leks (State Wildlife Agencies' Ad Hoc Committee for Sage-Grouse and Oil and Gas Development 2008).

Declines in lek attendance associated with oil and gas development may be a result of a suite of factors;

however, fragmentation of habitat is the predominant issue (USFWS 2010). Wyoming adopted a "core area" concept that protects the largest populations of sage-grouse. The BLM adopted this concept and added "focus areas" in the PRB area to supplement the core concept. Sage-grouse core/focus areas assume those sufficient amounts of good quality sage-grouse habitat remains un-fragmented by energy or other man-made infrastructure. These basic concepts for management are based on the assumptions that sufficient "islands" of undisturbed (by human infrastructure) sage-grouse habitat would remain to sustain a large enough sage-grouse population for the long-term.

State-wide, core population areas are probably sufficient since they encompass approximately 70 percent of the sage-grouse population; however, in the PRB area the core population / focus areas capture approximately 25 percent of the PRB area's sage-grouse population. To address this inadequacy of core/focus areas in the PRB, the BLM, in coordination with the State of Wyoming identified areas (between core areas in Wyoming and Montana) as "connectivity" habitat in an effort to maintain a viable greater sage-grouse population in the PRB area.

The PR2SS project will transverse through an estimated 20 miles of designed connectivity habitat (approximately 2 miles are BLM managed lands) in T52 – 55N, R78W and T51N, R79W; and an estimated 17.5 miles of core/focus Area (approximately 2.6 miles are BLM managed) in T46 and 47N, R78W and in T52N, R79 and 80N. WGFD records indicate that 61 occupied sage-grouse leks (7 on BLM managed lands) occur within 4 miles of the proposed PR2SS project. The State Wildlife Agencies' Ad Hoc Committee for Consideration of Oil and Gas Development Effects to Nesting Habitat (2008) recommends that BLM consider impacts for leks within 4 miles of oil and gas developments. A list of sage-grouse leks within 4 miles is in the project file.

3.4.3. Sensitive Species

Wyoming BLM list sensitive species on which to focus management efforts towards maintaining habitats under a multiple use mandate. The goals of the policy are to:

- Maintain vulnerable species and habitat components in functional BLM ecosystems
- Ensure sensitive species are considered in land management decisions
- Prevent a need for species listing under the ESA
- Prioritize needed conservation work with an emphasis on habitat

The authority for the sensitive species policy and guidance comes from the Endangered Species Act of 1973, Title II of the Sikes Act, the FLPMA, the Department Manual 235.1.1A, and WY BLM policy. BLM Wyoming sensitive species that occur in the project area are in sensitive species worksheet in Appendix B. The table also includes a brief description of the habitat requirements for each species.

3.4.3.1. Migratory Birds

The PRB FEIS discussed the affected environment for migratory birds on pp. 3-150 to 3-153. Migratory birds are birds that migrate for breeding and foraging at some point in the year. The BLM-USFWS MOU (2010) promotes the conservation of migratory birds, as directed through Executive Order 13186 (Federal Register V. 66, No. 11). BLM must include migratory birds in every NEPA analysis of actions that have potential to affect migratory bird species of concern to fulfill obligations under the MBTA. BLM encourages voluntary design features and conservation measures that comport with those in the programmatic mitigation in Appendix A of the PRB ROD (2003).

3.4.4. Big Game

Big game species occur ring in the PR2SS project area include pronghorn, mule deer, white-tailed deer, and elk. Pronghorn and deer yearlong range is found throughout the project area. Both pronghorn and mule deer rely heavily upon sagebrush for food and cover which occurs extensively throughout the PR2SS area. There is no identified crucial big game winter range for pronghorns or the two species of

deer in the project area. The eastern segment of the proposed seismic line crosses through yearlong and crucial winter/parturition range of the Fortification Creek elk herd.

3.4.5. Raptors

The PRB FEIS discussed the affected environment for raptors on pp. 3-141 to 3-148. Ten raptor species are known to nests occur of PR2SS. The rough-legged hawk is common in the late fall and winter when the project activities will occur. The BLM BFO database indicates 107 documented raptor nests within 0.5 miles of the proposed seismic lines.

Raptors Known to Nest in the Powder River 2D Seismic Survey Project Area.

Golden eagle	Northern harrier	Red-tailed hawk	American kestrel
Great-horned owl	Swainson's hawk	Burrowing owl	Short-eared owl
Ferruginous hawk	Long-eared owl	American kestrel	

3.4.6. Sharp-Tailed Grouse

The affected environment for plains sharp-tailed grouse is discussed in the PRB FEIS on pp. 3-148 to 3-150. Sharp-tailed grouse inhabit short and mixed-grass prairie, sagebrush shrublands, woodland edges, and river canyons. In Wyoming, this species is found where grasslands are intermixed with shrublands, especially wooded draws, shrubby riparian area, and wet meadows. Sharp-tailed grouse are known to occur in the project area.

3.5. Cultural/Historical Resources

3.5.1. Affected Environment

A Class III cultural resource inventory was performed for the BLM surface portions of the PR2SS prior to on-the-ground project work (BFO project no. 70110071), except for BLM surface in T54N R78 W Section 20 where casual use is proposed with handy laying receiver lines and no vehicular traffic. A class III cultural resource inventory following the Archeology and Historic Preservation, Secretary of the Interior's Standards and Guidelines (48CFR190) and the *Wyoming State Historic Preservation Office Format, Guidelines, and Standards for Class II and III Reports* was provided to BFO by Golder Associates. Clint Crago, BLM Archaeologist, reviewed the report for technical adequacy and compliance with Bureau of Land Management (BLM) standards, and determined it to be adequate. The following resources are located in or near the project area.

Site Number	Site Type	Eligibility
48JO2014	Prehistoric Lithic Scatter	Not Eligible
48JO2015	Prehistoric Lithic Scatter	Unevaluated
48JO2331	Prehistoric and Historic Artifact Scatter	Not Eligible
48JO2332	Prehistoric and Historic Artifact Scatter	Not Eligible
48JO2422	Historic Road	Not Eligible
48JO2585	Historic Road	Not Eligible
48JO2874	Prehistoric and Historic Artifact Scatter	Not Eligible
48JO2884	Prehistoric Lithic Scatter	Unevaluated
48JO2943	Historic Road	Not Eligible

Site Number	Site Type	Eligibility
48JO2973	Prehistoric and Historic Artifact Scatter	Not Eligible
48JO2982	Historic Stockherding	Eligible
48JO3064	Prehistoric and Historic Artifact Scatter	Not Eligible
48SH258	Chicago, Burlington, and Quincy Railroad	Unevaluated

4. ENVIRONMENTAL EFFECTS

This section describes the environmental effects of the proposed action, Alternative B. The effects analysis addresses the direct and indirect effects of implementing the proposed action, the cumulative effects of the proposed action combined with reasonably foreseeable Federal and non-federal actions, identifies and analyzes mitigation measures (COAs), and discloses any residual effects remaining following mitigation. For a discussion of the environmental consequences of Alternative A, the no action, see the PRB FEIS.

4.1. Alternative A

The No Action Alternative was analyzed in the PRB FEIS (Alternative A) and is incorporated into this EA, by reference.

4.2. Alternative B

The resources identified as being adequately analyzed in previous NEPA documentation (Table 3.2) were reviewed for environmental consequences. The direct, indirect and cumulative effects that would result from implementation of the new proposed action are similar (both quantitatively and qualitatively) to effects analyzed in the existing NEPA documentation listed in Table 4.1 and will not be analyzed further.

Table 4.1. Lists Existing NEPA Documentation that Addressed Environmental Effects

	Approved POD	NEPA Document	Approval Date
1	Big Corral	WY-070-07-043	9/11/2006
2	Jewell Draw	WY-070-04-199	9/15/2006
3	Big Cat	WY-070-03-009	1/10/2003
4	Ruby	WY-070-04-264	9/27/2004
5	Whiskey Draw Unit	WY-070-04-201	7/21/2004
6	Coal Gulch	WY-070-04-161	7/30/2004
7	Highland Unit	WY-070-04-161	7/30/2004
8	Buckskin	WY-070-04-236	2/11/2005
9	Cedar Draw Additions POD	WY-070-05-136	2/25/2005
10	Nemesis	WY-070-05-157	9/13/2005
11	Skyward	WY-070-05-187	9/23/2005
12	Coulter 2	WY-070-05-224	7/20/2005
13	Mooney Draw	WY-070-06-316	9/29/2006
14	Whiskey Draw Additions	WY-070-05-261	9/15/2005
15	Michelena	WY-070-05-295	9/29/2006
16	Crazy Woman North	WY-070-05-401	2/17/2006
17	Mitchell Draw I	WY-070-06-069	4/4/2006

18	Big Corrall Jewel Draw Add	WY-070-06-156	4/14/2006
19	Coal Gulch Beta CGU	WY-070-06-246	9/22/2006
20	Cat Creek POD	WY-070-04-136	9/9/2004
21	Stewart Draw	WY-070-07-115	4/23/2007
22	Coulter 5	WY-070-07-123	9/7/2007
23	Edisto	WY-070-07-075	9/5/2007
24	Highland Unit Gamma	WY-070-07-195	9/28/2007
25	Cat Creek Add 1 Amend	CX 070-06-3-006 thru 009	9/6/2007
26	Quarter Circle Nine Beta	WY-070-08-055	8/4/2008
27	Big Corral Jewel Draw Gamma	WY-070-08-168	9/4/2008
28	Rose Draw Unit Beta	WY-070-08-186	9/25/2008
29	Tear Drop	WY-070-08-072	4/4/2008
30	Coulter 4	WY-070-08-169	9/18/2008
31	Coal Gulch Unit Gamma	CX-070-390CX3-11-64 thru 128	12/10/2010
32	Stewart Draw Beta	WY-070-09-159	1/8/2010
33	Highland Unit Delta	WY-070-10-383	9/29/2010
34	Cat Creek Add	CX 070-06-3-006 thru 009	6/30/2006
35	Central Kitty	WY-070-01-173	7/5/2001
36	Central Kitty Additional Wells	WY-070-02-025	12/3/2001
37	Kitty H	WY-070-01-217	9/4/2001
38	Kitty I	WY-070-02-007	10/18/2001

NOTE: The proposed Powder River 2D Seismic Survey project will have potential impacts effecting wildlife and cultural resources thus BLM reviewed environmental effects in the following sections.

4.2.1. Soils & Vegetation

4.2.1.1. Direct and Indirect Effects:

Short-term surface disturbance as a direct result of the seismic survey operations including drill buggy passage to source locations and receiver line traffic areas, total approximately **35.75 acres** along the **25 miles** of line estimated on BLM properties in the project area. Disturbance consists of the following: In some instances, tree limbs **may** be removed to allow passage of drill buggies and to prevent additional damage to the affected tree. Vegetation beneath the tires would be compressed; perennial grasses and herbaceous species would be flattened but would typically recover in the current or next growing season.

Operator Committed Measures to Mitigate Overall Impacts to Soil & Vegetation:
Soil Resource Protection

- No cross-country travel would be permitted on slopes greater than approximately 25% by drill buggies. Heliportable drills will be used on slopes great than 25%
- No vehicles would be operated during periods of saturated soil conditions when surface ruts greater than 4 inches would occur along straight travel routes.
- Buggy drills traffic would be planned to minimize the number of passes over the same ground, and to minimize the potential for soil compaction and for impacts to biological soil crusts.
- Vehicles would be instructed to travel at slow speeds to limit disturbance to soils and vegetation.
- The spinning of all vehicle tires would be avoided where possible to minimize the potential for soil displacement.

Vegetation Resources Protection

- All equipment, including on-road and off-road equipment, would be cleaned to remove weed seed and soil (may contain weed seed) prior to commencing operations.

- Larger shrubs, trees, and other obstacles would be avoided where possible; no cutting or removal of shrubs, trees, or other obstacles is proposed.

4.2.1.2. Cumulative Effects

Proposed project will total approximately 35.75 acres of disturbance along the 25 miles of line estimated on BLM properties in the project area. The type of disturbance is and extent is described in detail above in section 4.1.1.1.

4.2.1.3. Mitigation Measures

BLM will consider using the mitigation measures and reclamation measures in Annex C, Reclamation, in the event of an unlikely blowout, large fuel (hydraulic, transmission etc.) fluid spill, rutting in excess of 4-inches, or other events occur which surpass those embodied in the project design.

4.2.1.4. Residual Effects

Woody species, such as sagebrush, may be damaged, particularly the older, more brittle stems, but the younger more flexible parts of the plant would likely bend under the pressure and typically recover within the current or next growing season.

4.2.2. Wildlife

4.2.2.1. Threatened, Endangered and Candidate

4.2.2.1.1. Threatened - Ute Ladies'Tresses Orchid (ULT)

4.2.2.1.1.1. Direct and Indirect Effects

The potential for impacting undocumented populations of ULTs or their habitat is low because no equipment, only foot traffic laying receiver lines, will be used in swampy/wetland areas**.** The operator committed; not to drill shot holes within from per 100 feet from perennial surface water features, not to remove wetland/riparian vegetation during the placement of geophones, and to have no operations other than receiver placement performed within 200 feet or a greater distance of a spring. The PR2SS project "*may effect but will not likely to adversely effect individuals or habitat*".

4.2.2.1.1.2. Cumulative Effects

The cumulative effects to ULT are discussed in the PRD FEIS (p. 4-253 to 4-254).

4.2.2.1.1.3. Mitigation Measures

No equipment, only foot traffic laying receiver lines, will be allowed in swampy/wetland areas.

4.2.2.1.1.4. Residual Effects

There will be no residual effects.

4.2.2.1.2. Candidate - Greater Sage-Grouse

4.2.2.1.2.1. Direct and Indirect Effects

The proposed PR2SS project would not occur during sage-grouse breeding season and nesting or during early brood-rearing period. Potential disturbance or displacement to the sage-grouse or their broods may occur on a temporary basis during recording activities. Because activities will not occur when grouse are nesting or chicks are flightless no direct impacts are expected to occur from the proposed action. Dispersal of sage-grouse during seismic activities (from vehicles, helicopters or humans) may result in increased predation or stress associated with being disturbed or displaced. Crushing of tall sagebrush could affect wintering habitat for greater sage grouse; however, vegetation changes as a result of project operations would be minimal and would occur in only a small percentage of the total project area.

Potential disturbance to sage-grouse from project activities associated with proposed action is expected to be short term and minor. Considering the fact that source acquisition activities will be conducted outside

of the nesting season for greater sage-grouse, combined with the general lack of long-term impacts to sagebrush habitats in the area, it is unlikely that the geophysical project would have an adverse effect upon sage grouse nesting and early brood-rearing habitats in future years. The PR2SS project: "*may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or a loss of viability to the population or species*".

4.2.2.1.2.2. Cumulative Effects

In addition to the direct impacts to sage-grouse habitat created by the PR2SS project does contain coalbed natural gas (CBNG) and conventional oil and gas development along with supporting infrastructure such as roads, powerlines, pipelines, water treatment facilities and reservoirs. Livestock grazing also occurs which effects alters vegetative cover available to sage-grouse.

Recent research suggests that the cumulative and synergistic effects of current and foreseeable energy development in the vicinity of the project area are likely to impact the local sage-grouse populations, cause declines in lek attendance, and may result in local extirpation. The cumulative impact assessment area (CIAA) for this project encompasses a 4 mile radius around the 61 sage-grouse leks that occur within 4 miles of the project boundary. This covers an area of approximately 1,500 square miles. Analysis of impacts up to 4 miles was recommended by the State Wildlife Agencies' Ad Hoc Committee for Consideration of Oil and Gas Development Effects to Nesting Habitat (2008).

4.2.2.1.2.3. Mitigation Measures

Should geo-exploration activities extend into sage-grouse breeding season (March 1 – June 15), timing restrictions will be placed on activities within 2 miles of identified leks and in core/connectivity areas.

4.2.2.1.2.4. Residual Effects

Because activities will be conducted outside of the nesting season for sage-grouse, and with the general lack of long-term impacts to sagebrush habitats in the area, it is unlikely that the geophysical project would have an adverse effect upon sage-grouse nesting and early brood-rearing habitats in future years.

4.2.2.2. Sensitive Species

4.2.2.2.1. Direct and Indirect Effects:

Temporary displacement of sensitive species from areas where operations are being conducted to adjacent suitable habitat is expected; however, impacts of this nature would be short-term, localized, and negligible. Bald eagles roosting in cottonwood galleries along the Clear Creek, Crazy Women Creek and Powder River would be disturbed by people and vehicles moving through the area and by the proposed helicopter activity.

4.2.2.2.2. Cumulative Effects:

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-273.

4.2.2.2.3. Mitigation Measures

Timing restrictions will be placed within 1 mile of the Clear Creek, Crazy Women Creek, and Powder River, known eagle wintering areas, from November 1 until April 1 unless surveys show that eagles are not using the area.

4.2.2.2.4. Residual Effects

No further impacts identified.

4.2.2.3. Big Game

4.2.2.3.1. Direct and Indirect Effects:

Some big game animals will be displaced for a short term period during activities along the seismic line route. Some vegetation used by big game as forage will be crushed but should recover. Elk on the crucial range in the Fortification area should not be disturbed if project activities occur before the November 15 timing limitation.

4.2.2.3.2. Cumulative Effects:

The cumulative effects associated with the project are within the analysis parameters and impacts from oil and gas associated development is described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, pg. 4-181 to 4-215.

4.2.2.3.3. Mitigation Measures

To prevent disturbance to elk wintering in the Fortification area, activities will not be allowed in the designated crucial range from November 15 through April 30.

4.2.2.3.4. Residual Effects

Impacts to big game animals from the proposed project will be minor and short term.

4.2.2.4. Migratory Birds

4.2.2.4.1. Direct and Indirect Effects:

Disturbance from the presence of people and vehicles will cause birds to disperse. There will be a minor loss to vegetation which serves as cover and forage to migratory birds. The timing of the project activities in the late fall and winter is at a time when migratory bird use of the Powder River basin is at its lowest reducing the potential impacts.

4.2.2.4.2. Cumulative Effects:

The cumulative effects associated with the project are within the analysis parameters and impacts from oil and gas associated development is described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, pg. 4-235.

4.2.2.4.3. Mitigation Measures

No mitigation will be applied for the project.

4.2.2.4.4. Residual Effects

No further effects are known.

4.2.2.5. Raptors

4.2.2.5.1. Direct and Indirect Effects

Wintering raptors will be disturbed by project activities. The project is scheduled to be completed before nesting raptors return to the area so impacts to raptors should be minimal. Should activities continue into the nesting season (Februaury 1 – July 31) raptor nests could be impacted. Human activities in close proximity to active raptor nests may interfere with nest productivity. Romin and Muck (1999) indicate that activities within 0.5 miles of a nest are prone to cause adverse impacts to nesting raptors. If mineral activities occur during nesting, they could be sufficient to cause adult birds to remain away from the nest and their chicks for the duration of the activities. This absence can lead to overheating or chilling of eggs or chicks and can result in egg or chick mortality. Prolonged disturbance can also lead to the abandonment of the nest by the adults. Routine human activities near these nests can also draw increased predator activity to the area, resulting in increased nest predation.

To reduce the risk of decreased productivity or nest failure, the BLM BFO requires a 0.5 mile radius

timing limitation during the breeding season around active raptor nests and recommends all infrastructure requiring human visitation be located in such a way as to provide adequate biologic buffer for nesting raptors. A biologic buffer is a combination of distance and visual screening that provides nesting raptors with security such that they will not be flushed by routine activities.

Direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS (pp. 4-216 to 4-221).

4.2.2.5.2. Cumulative Effects

The cumulative effects associated with the project are within the analysis parameters and impacts from oil and gas associated development is described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, pg. 4-221.

4.2.2.5.3. Mitigation Measures

Should project activities extend into raptor nesting season (February 1 –July 31), timing restrictions will be placed on project activities until surveys show that raptor nests are inactive.

4.2.2.5.4. Residual Effects

No further effects are known.

4.2.2.6. Sharp-tailed Grouse

4.2.2.6.1. Direct and Indirect Effects

The project will disturb some of the vegetation that could provide food and cover for sharp-tailed grouse. No leks will be impacted by the project.

4.2.2.6.2. Cumulative Effects

The cumulative effects associated with the project are within the analysis parameters and impacts from oil and gas associated development is described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, pg. 4-225 to 4-226.

4.2.2.6.3. Mitigation Measures

No mitigation will be applied for the project.

4.2.2.6.4. Residual Effects

No further effects are known.

4.2.3. Cultural Resources

4.2.3.1. Direct and Indirect Effects

All unevaluated or eligible sites within the project area will be avoided by project activities. Following the Wyoming State Protocol Section VI(A)(4) the Bureau of Land Management electronically notified the Wyoming State Historic Preservation Officer (SHPO) on 8/29/2011 that no historic properties will be affected by the project.

4.2.3.2. Residual Effects

Exploration, construction and development of oil and gas resources impacts cultural resources through ground disturbance, unauthorized collection, and visual intrusion of the setting of historic properties. This results in fewer archaeological resources available for study of past human life-ways, changes in human behavior through time, and interpreting the past to the public. Additionally, these impacts may compromise the aspects of integrity that make a historic property eligible for the National Register of Historic Places. Recording and archiving basic information about archaeological sites and the potential

for subsurface cultural materials in the proposed project area serve to partially mitigate potential cumulative effects to cultural resources.

4.2.3.3. Mitigation Measures

If any cultural values [sites, artifacts, human remains (Appendix L PRB FEIS)] are observed during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo Field Manager notified. Further discovery procedures are explained in the Standard COA (General)(A)(1).

4.2.3.4. Cumulative

During project activities, there will be numerous crews working across the project area using heavy construction equipment without the presence of archaeological monitors. Due to the extent of work and the surface disturbance caused by large vehicles, it is possible that unidentified cultural resources can be damaged by construction activities. The increased human presence associated with the construction phase can also lead to unauthorized collection of artifacts or vandalism of historic properties.

4.2.4. Safety

BLM will consider having APC and DG comply with pertinent provisions of the Bureau of Alcohol, Firearms, and Tobacco regulations when dealing with explosives in order to protect themselves, the public, public and private lands. BLM will consider having APC, DG, and their helicopter operating agent comply with the FARs and assuming the responsibility for conducting a pre-operations hazards survey for low-level flight for flight hazards attached to or on the BLM surface in the PR2SS area (wires, towers, guywires, blowing debris, etc.) prior to beginning geophysical survey. APC, DG, or its helicopter operating agent will maintain and update the hazards throughout the geophysical survey. The history of low-level helicopter operations consists of generations of wire, tower, debris, and bird strikes (BFO incorporates the pertinent rotary wing accident files from the National Transportation Safety Board, US Army and Navy Safety Centers here by reference). The PR2SS project area, see the map in Figure 3.1, contains over 38 CBNG projects which have a mass of unmarked overhead powerlines, towers, and other hazards to low level flight.

5. CONSULTATION/COORDINATION:

Contact	Title	Organization
Bud Stewart	Wildlife Biologist	USGF
Brad Rogers	Wildlife Biologist	USFWS
Pauline Schuette	Wildlife Biologist	USFWS
Mary Hopkins	Wyoming SHPO	Wyoming SHPO

6. LIST OF INTERDISCIPLINARY TEAM PREPARERS and REVIEWERS

Andy Perez, Natural Resource Specialist
Casey Freise, Supervisory Natural Resource Specialist
Clint Crago, Archaeologist
Donald Brewer, Wildlife Biologist
Kerry Aggen, Geologist
Chris Durham, Assistant Field Manager, Resources
Clark Bennet, Associate Field Manager, Minerals & Lands
John Kelley, Planning & Environmental Coordination
Chris Durham, Assistant Field Manager
Duane W. Spencer, Field Manager

Interdisciplinary Team Lead: Andy Perez

7. REFERENCES and AUTHORITIES

The National Environmental Policy Act of 1969 (NEPA), as amended (Pub. L. 91-90, 42 U.S.C. 4321 et seq.).

Code of Federal Regulations (CFR)

- 14 CFR All Parts and Sections comprising the Federal Aviation Regulations.
- 40 CFR All Parts and Sections inclusive Protection of Environment Revised as of July 1, 2001.
- 43 CFR All Parts and Sections inclusive - Public Lands: Interior. Revised as of October 1, 2000.

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Appendix A: Notice of Intent (NOI)

BLM Form 3150-4
FS Form 2800-16
(May 2006)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FORM APPROVED
OMB NO. 1004-0162
Expires: February 28, 2009

NOI Case File No.

NOTICE OF INTENT AND AUTHORIZATION TO CONDUCT OIL AND GAS GEOPHYSICAL EXPLORATION OPERATIONS

Lessee or Operator: Anadarko Petroleum Operations		Project Name: Powder River 2D lines 1 & 2 job #10211	
Address: 1201 Lake Robbins Dr.		Do you have a bond on file with the Agency? ☑ Yes ☐ No	
City: The Woodlands	State: TX	Which Agency? ☑ BLM ☐ Forest Service	
Zip Code: 77380	Phone No. *(Include area code)*: 832-636-3247	Bond No.: B000784	Bond Amount: $ 50,000
E-Mail Address: Johnmoran@anadorko.com			

Geophysical Co.: Dawson Geopysical Company		Geophysical Co. Representative: Bill Michaeli/Michaeli Land Service	
Address: 508 W. Wall, Suite 800		Address: PO Box 1749	
City: Midland	State: TX	City: Douglas	State: WY
Zip Code: 79701	Phone No. *(Include area code)*: 303-720-2229	Zip Code: 82633	Phone No. *(Include area code)*
E-Mail Address: zirschky@dawson3d.com		Cellular Phone No. *(Include area code)*: 970-471-4878	

Local Rep./Party Chief: Zane Zirschky

1. Legal Description: Give the legal and land description of the lands involved using Meridian, Township, Range, and Section(s), or metes and bounds as appropriate:

Sheridan
54N-78W SEC 20, NENE, NESE, 53N-78W SEC 5 E2E2, NWNE
Johnson
53N-78W SEC 32 E2NE, SWNE, SESE, 52N-78W SEC 4 SWNE, W2, SE, SEC 5 N2NE, NW, N2SW, SEC 31 S2SE, SEC 32 S2NE, SENW, SEC 33 NE, E2W2, SWNW, W2SW, 52N-79W SEC 33 N2, SEC 34 NW, N2SW, SESW, 51N-78W SEC 1 S2NE, W2, SE, SEC 2 S2, SEC 3 E2NE, NESE, SEC 20 N2N2, 50N-78W SEC 5 ALL, SEC 8 ALL, SEC 17 ALL, SEC 20 N2N2, S2S2, SEC 29 ALL, 49N-78W SEC 8 ALL, SEC 17 ALL, SEC 20 E2, NW, N2SW, SEC 29 S2SW, 48N-78W SEC 19 S2, 48N-78W SEC 30 E2, 47N-78W SEC 19 W2NE, 46N-78W SEC 6 SE, SEC 7 E2, 51N-77W SEC 4 E2SE, SEC 6 S2, SEC 9 E2NE, SWNE, SEC 10 N2, NESE, SEC 11 W2, SEC 12 E2NE, SWNE, NWNW, SE, 51N-76W SEC 7 S2N2, S2, SEC 8 SWNW, S2
Campbell
51N-76W SEC 9 W2SW, SESW, SEC 10 E2, SESW, SEC 11 ALL, SEC 12 N2, SW, S2SE, NESE, 51N-75W SEC 13 SESW, SEC 14 SESW, SEC 15 W2SW

You must also submit a map with a minimum scale of one-half inch per mile showing the general area and project location. We recommend a 7 1/2-minute USGS quadrangle or the scale commonly used in the area. For seismic operations, your maps should include source and receiver lines, surface ownership, and any Federal lands under lease. When survey lines are along property boundaries between Federal and private lands, indicate which side of the line you will use.

2. Do you hold any Federal leases within the project area? ☑ Yes ☐ No (If yes, indicate location and lease numbers on an attached map.) Note: There is no fee for operations on your Federal lease.

3. If you are proposing seismic exploration, how many miles of source line (2-D), or acres (3-D) (to the nearest 10 acres) of survey are on:

a. Your Federal Lease: Yes b. Other Federal lands: _____

4. When do you expect to start exploration? Aug. 1, 2011 How long will the project last? 90 days.

Describe any of your critical time frames associated with the proposed project, such as equipment or contractor availability.

We need to start as soon as we have a cre available.

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. (Section 1212 make it a crime for any person knowingly and willfully to make to any Department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(Continued on page 2)

Description and Type of Operations *(check all that apply)*:

a. Survey Type: ☑ 2-D ☐ 3-D ☐ Gravity/Magnetic ☐ Other (explain): _____

Describe the survey type:

b. Survey Method: ☐ Surface charge ☑ Shothole ☐ Vibroseis ☐ Other (explain): _____

What type and amount of explosives per source point will you use? Vibrogel 20#

What shotpoint pattern and spacing will you use? one shot 20# What will be the shothole depth? 80 ft

Did you attach or display a diagram of the shotpoint pattern on the project map? ☑ Yes ☐ No

Describe the survey method:

Please see POA

c. Transport Method: ☐ Vibrator Trucks ☑ Pick-up Truck ☑ Buggy/ATV ☑ Backpack ☐ Helicopter

Describe your transportation plans, including types and numbers of vehicles and how you will access the project area:

Please see POA

d. Operating Procedures--Describe your operating procedures. including how you will minimize surface impacts. Describe support facilities you need, such as helispots, camps, or powder magazines; construction of roads or trails, proposed plugging procedures for shotholes; and general clean-up procedures:

Please see POA

(Continued on page 3)

Terms and Conditions

1. The Bureau of Land Management (BLM) or Forest Service (FS) (Agency) must approve any Surface disturbing activities in addition to those approved in this NOI, such as route changes, placement of magazines, towing with a tractor, blading, dozing, snow removal, and vegetation removal. I must notify the Agency in writing of any changes in the original proposal and have Agency approval in writing for the changes before proceeding with them. Stacking sourcepoints to avoid sensitive resources or areas does not require prior Agency approval.
2. This NOI expires on 1/30/2012, unless the Agency extends it in writing before that date.
3. I understand that this NOI does not grant any exclusive right to the described lands for geophysical exploration, or other purposes. The land area described above is at all times subject to any other lawful uses by the United States, its lessees, permittees. licensees, and assigns.
4. I must notify the Agency at least 2 days, but no more than 5, prior to initiating the project and entering upon the public lands.
5. In the field, each seismic crew must have with it a copy of the approved NOI and its terms and conditions.
6. The Agency may suspend or terminate this NOI if there is a violation of any of its conditions.
7. I must suspend operations when the operations may unnecessarily damage the surface, such as when rutting would occur due to wet soil conditions.
8. I must indemnify the United States for any liability for damage to life or property resulting from the occupancy or use of public lands under the NOI.
9. I must take all reasonable precautions to prevent and must suppress fires. The Agency may specify in writing the fire prevention and firefighting equipment I need. At my expense, I must extinguish all fires set or caused as a result of operations under this NOI and must report all fires to the Agency.
10. I must diligently protect from unnecessary damage United States land and property covered by this NOI. I must pay the United States for any damage resulting from my or my agents' or employees' violation of the terms of this NOI or any law or regulation applicable to the lands involved.
11. I must store and handle powder magazines and explosives according to U. S. Bureau of Alcohol, Tobacco and Firearms standards (see 27 CFR Part 55). I must properly secure loaded shotholes.
12. I must complete shothole plugging under Agency guidelines and the guidelines of any other local, Federal or State regulatory authority.
13. I must remove all materials and equipment I placed on the premises and restore the site to the Agency's satisfaction immediately after I complete the project unless the Agency approves other arrangements.
14. I must file a Notice of Completion (NOC) Form within 30 days after completing operations and reclamation. If the location of the project is different from that in the approved NOI, I must submit a revised map with the NOC (1:24,000 scale, where available), including source points.
15. I must pay to the United States $ N/A per _____ according to the regulations.
16. This geophysical exploration project is subject to the attached Conditions of Approval _____ through _____ and Exhibits _____.

WARNING: If you purposely give false or misleading information, you maybe fined $10,000, sent to prison, or both (see Title 18 U.S. C. 1001 statement on page 1).

I agree that I and my agents must conduct the geophysical exploration under all Federal, State and local laws, and applicable regulations and must comply with this NOI and any attached terms and conditions.

William J. Michaeli	William J. Michaeli	8/11/11
(Printed Name of Authorized Company Representative)	(Signature of Authorized Company Representative)	(Date)

(Printed Name of Agency Signing Officer)	(Signature of Agency Signing Officer)	(Title of Agency Signing Officer)	(Date)

NOTICES

The Privacy Act of 1974 and the regulation in 43 CFR 2.48(d) provide that you be furnished the following information in connection with information required by this Notice of Intent and Authorization to Conduct Oil and Gas Geophysical Exploration Operations.

AUTHORITY: 30 U.S.C. 181 et seq.

PRINCIPAL PURPOSE: We use the information to Process your Notice

ROUTINE USES: (1) The processing of the operator s Notice of Intent and Authorization to Conduct Oil and Gas Geophysical Exploration Operations. (2) To determine that mitigating measures are made to protect the environment. (3) Transfer to appropriate Federal agencies when concurrence is required prior to granting a right in public lands or resources, (4) Information from the record and/or the record will be transferred to appropriate Federal, State, local or foreign agencies when relevant to civil, criminal or regulatory investigations or prosecutions.

EFFECT OF NOT PROVIDING INFORMATION: Disclosure of the information is voluntary. If all the information is not provided, your right to conduct geophysical exploration activities may be revoked.

The Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.) requires us to inform you that:
BLM will collect this information under 43 CFR 3150.
FS will collect this information under 36 CFR 251.15.
BLM/FS will use this information to process geophysical exploration notices.
Response to this request is required to obtain a benefit.

BLM would like you to know that you do not have to respond to this or any other Federal agency-sponsored information collection unless it displays a currently valid OMB control number.

BURDEN OF HOURS STATEMENT: Public reporting burden for this form is estimated to average 1 hour per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing of the form. Direct comments regarding the burden estimate or any other aspect of this form to the U.S. Department of the Interior, Bureau of Land Management (1004-0162), Bureau Information Collection Clearance Officer (WO-630), 1849 C Street, N.W, Mail Stop 401 LS, Washington, D C. 20240.

(BLM Form 3150-4 and FS Form 2800-16, page 3)

Appendix B: Threatened, Endangered, Proposed, and Candidate Species Worksheet

Common Name	Habitat	Presence? (NP, NS, S, K)	Direct Impacts Anticipated?	Intend to apply COA?	Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS?
Endangered					
Black-footed ferret	Black-tailed prairie dog colonies or complexes > 1,000 acres.	No	No	No	4-251, BA & BO
Threatened					
Ute ladies'-tresses orchid	Areas with appropriate hydrology	Possible	No	Yes	4-253, BA & BO
Candidate					
Greater sage-grouse	Basin-prairie shrub, mountain-foothill shrub	K	Yes	Yes	4-257 to 4-273

Sensitive Species worksheet

Common Name	Habitat	Presence? (NP, NS, S, K)	Direct Impacts Anticipated?	Intend to apply COA?	Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS?
Amphibians					**4-258**
Northern leopard frog	Beaver ponds and cattail marshes from plains to montane zones.	S	No	No	
Columbia spotted frog	Ponds, sloughs, small streams, and cattails in foothills and montane zones. Confined to headwaters of the S Tongue R drainage and tributaries.	NP	No	No	

Common Name	Habitat	Presence? (NP, NS, S, K)	Direct Impacts Anticipated?	Intend to apply COA?	Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS?
Fish					**4-259 & 4-260**
Yellowstone cutthroat trout	Cold-water rivers, creeks, beaver ponds, and large lakes in the Upper Tongue sub-watershed	NP	No	No	
Birds					**4-260 to 4-264**
Baird's sparrow	Shortgrass prairie and basin-prairie shrubland habitats; plowed and stubble fields; grazed pastures; dry lakebeds; and other sparse, bare, dry ground.	NS	No	No	
Bald eagle	Mature forest cover often within one mile of large water body with reliable prey source nearby.	K	Yes	Yes	4-251 to 4-253 & BA
Brewer's sparrow	Sagebrush shrubland	K	Yes	No	
Ferruginous hawk	Basin-prairie shrub, grasslands, rock outcrops	K	No	Yes	
Loggerhead shrike	Basin-prairie shrub, mountain-foothill shrub	K	Yes	No	
Long-billed curlew	Grasslands, plains, foothills, wet meadows	S	No	No	
Mountain plover	Short-grass prairie with slopes < 5%	S	No	No	4-254, 4-255 & BA
Northern goshawk	Conifer and deciduous forests	NS	No	No	
Peregrine falcon	Cliffs	NS	No	No	
Sage sparrow	Basin-prairie shrub, mountain-foothill shrub	NS	No	No	
Sage thrasher	Basin-prairie shrub, mountain-foothill shrub	NS	No	No	
Trumpeter swan	Lakes, ponds, rivers	NP	No	No	
Western Burrowing owl	Grasslands, basin-prairie shrub	S	No	No	

Common Name	Habitat	Presence? (NP, NS, S, K)	Direct Impacts Anticipated?	Intend to apply COA?	Direct, indirect, and/or cumulative impacts anticipated beyond the level analyzed within the PRB FEIS?
White-faced ibis	Marshes, wet meadows	S	No	No	
Yellow-billed cuckoo	Open woodlands, streamside willow and alder groves	S	No	No	
Mammals					**4-264 &4-265**
Black-tailed prairie dog	Prairie habitats with deep, firm soils and slopes less than 10 degrees.	K	Yes	No	4-255, 4-256
Fringed myotis	Conifer forests, woodland chaparral, caves and mines	NS	No	No	
Long-eared myotis	Conifer and deciduous forest, caves and mines	NS	No	No	
Spotted bat	Cliffs over perennial water.	NS	No	No	
Swift fox	Grasslands	S	No	No	
Townsend's big-eared bat	Caves and mines.	NS	No	No	
Plants					**4-258**
Limber pine	Mountains, associated with high elevation conifer species	NP	No	No	
Porter's sagebrush	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.	NP	No	No	
William's wafer parsnip	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides, 6000-8300 ft.	NP	No	No	

Appendix C: RECLAMATION REQUIREMENTS, WY BLM

The following Reclamation Requirements apply to all surface disturbing activities, including BLM initiated activities, and must be addressed in each reclamation plan. These requirements also must be met prior to release of the bond and/or the reclamation liability. Where these Reclamation Requirements differ from other applicable federal, laws, rules, and regulations, those requirements supersede this policy. State and/or local statutes or regulations may also apply.

1. **Manage all waste materials:**
   a. Segregate, treat, and/or bio-remediate contaminated soil material.
   b. Bury only authorized waste materials on site. Buried material must be covered with a minimum of three feet of suitable material or meet other program standards.
   c. Ensure all waste materials moved off-site are transported to an authorized disposal facility.

2. **Ensure subsurface integrity, and eliminate sources of ground and surface water contamination.**
   a. Properly plug all drill holes and other subsurface openings (mine shafts, adits etc.).
   b. Stabilize, properly back fill, cap, and/or restrict from entry all open shafts, underground workings, and other openings.
   c. Control sources of contamination and implement best management practices to protect surface and ground water quality.

3. **Re-establish slope stability, surface stability, and desired topographic diversity.**
   a. Reconstruct the landscape to the approximate original contour or consistent with the land use plan.
   b. Maximize geomorphic stability and topographic diversity of the reclaimed topography.
   c. Eliminate highwalls, cut slopes, and/or topographic depressions on site, unless otherwise approved.
   d. Minimize sheet and rill erosion on/or adjacent to the reclaimed area. There shall be no evidence of mass wasting, head cutting, large rills or gullies, down cutting in drainages, or overall slope instability on/or adjacent to the reclaimed area.

4. **Reconstruct and stabilize water courses and drainage features.**
   a. Reconstruct drainage basins and reclaim impoundments to maintain the drainage pattern, profile, and dimension to approximate the natural features found in nearby naturally functioning basins.
   b. Reconstruct and stabilize stream channels, drainages, and impoundments to exhibit similar hydrologic characteristics found in stable naturally functioning systems.

5. **Maintain the biological, chemical, and physical integrity of** the **topsoil and subsoil** (where appropriate).
   a. Identify, delineate, and segregate all salvaged topsoil and subsoil based on a site specific soil evaluation, including depth, chemical, and physical characteristics.
   b. Protect all stored soil material from erosion, degradation, and contamination.
   c. Incorporate stored soil material into the disturbed landscape.
   d. Seed soils to be stored beyond one growing season, with desired vegetation.
   e. Identify stockpiles with appropriate signage.

6. **Prepare site for revegetation.**
   a. Redistribute soil materials in a manner similar to the original vertical profile.
   b. Reduce compaction to an appropriate depth (generally below the root zone) prior to redistribution of topsoil, to accommodate desired plant species.
   c. Provide suitable surface and subsurface physical, chemical, and biological properties to support the long term establishment and viability of the desired plant community.

d. Protect seed and seedling establishment (e.g. erosion control matting, mulching, hydro-seeding, surface roughening, fencing, etc.)

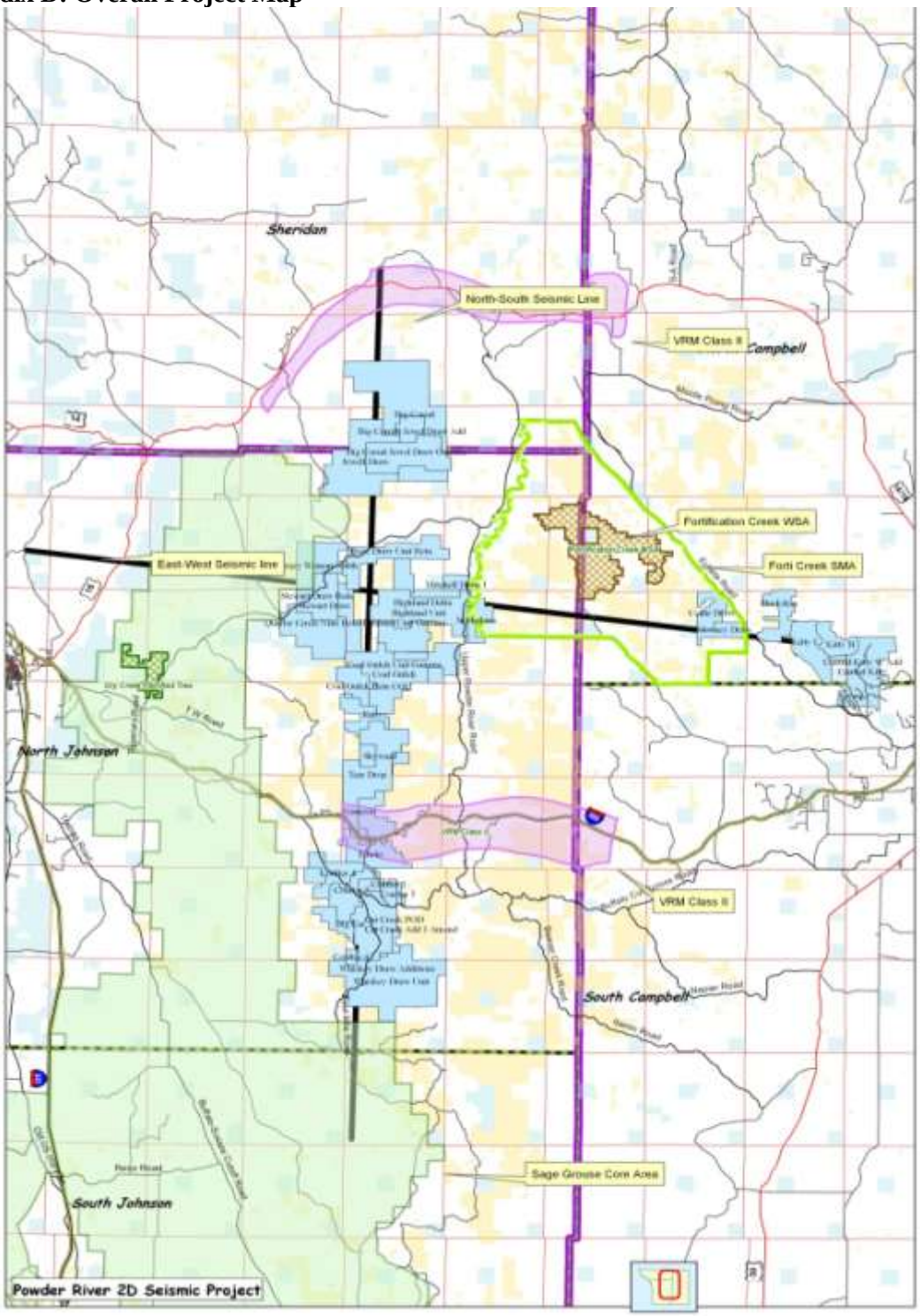
7. **Establish a desired self-perpetuating native plant community.**
   a. Establish species composition, diversity, structure, and total ground cover appropriate for the desired plant community.
   b. Enhance critical resource values (e.g. wildlife, range, recreation, etc.), where appropriate, by augmenting plant community composition, diversity, and/or structure.
   c. Select genetically appropriate and locally adapted native plant materials based on the site characteristics and ecological setting.
   d. Select non-native plants only as an approved short term and non-persistent alternative to native plant materials. Ensure the non-natives will not hybridize, displace, or offer long-term competition to the endemic plants, and are designed to aid in the re-establishment of native plant communities.

8. **Reestablish complementary visual composition**
   a. Ensure the reclaimed landscape features blend into the adjacent area and conform to the land use plan decisions.
   b. Ensure the reclaimed landscape does not result in a long term change to the scenic quality of the area.

9. **Manage Invasive Plants**
   a. Assess for invasive plants before initiating surface disturbing activities.
   b. Develop an invasive plant management plan.
   c. Control invasive plants utilizing an integrated pest management approach.
   d. Monitor invasive plant treatments.

10. **Develop and implement a reclamation monitoring and reporting strategy.**
   a. Conduct compliance and effectiveness monitoring in accordance with a BLM (or other surface management agency) approved monitoring protocol.
   b. Evaluate monitoring data for compliance with the reclamation plan.
   c. Document and report monitoring data and recommend revised reclamation strategies.
   d. Implement revised reclamation strategies as needed.
   e. Repeat the process of monitoring, evaluating, documenting/reporting, and implementing, until reclamation goals are achieved.

Appendix D: Overall Project Map

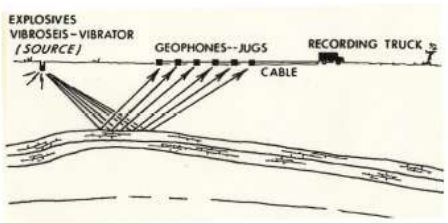


What is the energy source?

The energy source is usually either a small amount of dynamite in a shot hole, drilled to depths of up to 100 feet or vibrations generated by a series of "vibroseis" trucks. On some surveys, where circumstances warrant, both types of sources may be used.

How are the sound waves collected?

The reflected sound waves are detected by listening devices called geophones that are laid out along the seismic line. They are usually attached to cables, often over 3 miles in length, that connect to a recording truck, called a dog house. Where the seismic data is recorded onto computers.



What is the difference between 2D and 3D surveys?

2D seismic lines are single widely spaced lines in which the geophones, cables and sources are all on the same line.

3D seismic lines are a system of uniform grids lines in which the geophone or receiver lines run generally perpendicular to the separate sources lines. 3D surveys provide a much more detailed result.

What steps are involved on the survey?

There are three or four steps involved depending upon the survey. The first step is permitting of all necessary and appropriate landowners and government agencies, followed by a survey of points. If it is a shot hole survey, the next step is to drill the holes. The final step is to record the data. On a crew utilizing vibrators, the vibrators operate in conjunction with the recording crew.

Who will be on the project and when?

1) The first contact will be the permit agent or advance man who will obtain the permits and find out additional information, such as location of wells, pipelines and other cultural objects that we need to make allowance for. This may also involve location of utilities and making arrangements for crops or livestock. Their job also involves communicating permit conditions to all crew members following to ensure compliance.

2) After permitting, a survey crew will arrive to mark out the project with survey stakes or pin flags and access flagging. This is generally done with GPS (Global Positioning System) packs. This is a system of satellite receivers that enable very accurate positioning of surveyed points. As the project is laid out, surveyors take readings on houses, wells and other culture to allow adequate distance for compliance with exploration regulations or permit stipulations with source or energy points. Different colors are used for receiver and source points as it may be necessary to position geophones in locations that is impractical for energy to be applied. Source points may be offset away from obstacles or culture.


Surveyors

3) If there is heavy brush in areas, it may be necessary for a bush cutting crew to clean enough line for safe passage by work crews and equipment. Only enough brush is removed to facilitate work and only where allowed by permit.

4) Where dynamite is the energy source, the next operation is the drilling, loading and backfilling of the source points. There are many different types and sizes of drills designed for particular depths and subsurface conditions. Terrain and permit constraints may also affect the type of drill used. Some may require water for operations. A drill supervisor will coordinate all of these activities.


"Buggy" Drill

5) The recording crew will lay out the geophones and cables. This ground crew will walk through manually laying the equipment along the lines and connecting the whole network together. Occasionally, helicopters are used for moving equipment.

6) When enough geophones have been placed, recording can be started. Shot holes are sequentially detonated and the data is recorded.

In the case of "vibroseis" source operations, once the geophones are placed, vibrators move through the lines and shake at the marked points. Typically, 2-4 vibrators will simultaneously vibrate the ground.

Buggy Vibrator

7) At the completion of recording, all seismic lines will be completely cleaned of equipment, survey material and debris. Shot holes will be left in accordance with local regulations.

Who do I contact in case of problems or complaints?

Any crew member has contact information that contains numbers for supervisors or management, or can readily obtain it. A crew manager is responsible for all crew activity and has a local office, usually in a motel in an adjacent town.

The permit agent should also have provided his or her number and contact information on the permit.

In addition, the company office number is listed at the bottom of this page.

It is the aim of Michaeli Land Service, LLC. and the entire geophysical community to conduct our operations in a safe, diligent, and responsible manner. We will operate in accordance with all applicable local, state, and federal laws and regulations.

This brochure is provided to improve communication and understanding within the community.

Local Contact Info:
Michaeli Land Service, LLC
Best Western Main Street Inn
1562 E Main Street
Brawley, California 92227

Shelley Christiansen
Permit Agent
775.427.8340

MLS

Frequently Asked Questions

About Seismic Surveys and Geophysical Operations

What is a seismic survey?

It is a method of using sound waves from an energy source to determine information about the sub surface. Sound waves are sent into the earth where they are reflected off different rock layers present.