APPENDIX A

INTERIM DRILLING POLICY
DEVELOPMENT AUTHORIZED CONCURRENT WITH EIS PREPARATION FOR THE ATLANTIC RIM COALBED METHANE PROJECT

During the preparation of the Atlantic Rim Coalbed Methane Environmental Impact Statement (EIS), the Bureau of Land Management's (BLM) authority to allow drilling on the federal mineral estate is limited. The Council on Environmental Quality (CEQ) Regulations and 40 CFR 1506.1, *limitations on actions during NEPA process* to comply with the National Environmental Policy Act (NEPA) provide the following regarding limitation on concurrent authorizations:

Section 1506.1

(a) Until an agency issues a record of decision as provided in para. 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:

(1) Have an adverse environmental impact; or

(2) Limit the choice of reasonable alternatives.

(b) If any agency is considering an application from a non-federal entity, and is aware that the applicant is about to take an action within the agency's jurisdiction that would meet either of the criteria in paragraph (a) of this section, then the agency shall promptly notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved.

(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

(1) Is justified independently of the program;

(2) Is itself accompanied by an adequate environmental impact statement; and

(3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance....

The above regulations and the following criteria and conditions will be used by the BLM to determine new exploratory activities allowed on Federal surface and/or minerals during preparation of the EIS. They also establish conditions under which these activities will be approved. The intent of these criteria and conditions are to keep all activity within the scope of existing analysis and at a reasonable level, to allow limited drilling activity for acquisition of additional data necessary for completion of the EIS, and to prevent unnecessary hardship to

leaseholders. These criteria may be modified by the BLM authorized officer (AO) if any of the allowed activities are viewed as having a potentially significant effect on the environment or prejudice the ultimate decision on the drilling program for the EIS as outlined in the CEQ regulations quoted above.

ACTIVITIES ALLOWED ON FEDERAL LANDS AND MINERALS DURING EIS PREPARATION

1. A maximum of 200 coalbed methane wells will be allowed within the project area, for research and exploratory purposes, during the interim period in which the EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple zones to be evaluated (see map).

2. Activities within individual pods will be authorized by BLM. For any pod location which overlaps the boundary of a sensitive resource area for sage grouse, mountain plover, raptors, big game migration corridors, and sensitive plants, appropriate stipulations and mitigation will be applied to protect any sensitive resources present (see Term Definitions below). Some sensitive resources such as high density paleontological or cultural resources sites, are not mapped and will also be handled on a pod basis.

3. Existing coalbed methane wells (two wells re-completed as coalbed methane producers in the Cow Creek Unit by Double Eagle and one new well completed by Petroleum Development Corporation, to the east of this unit) will count toward the above well limits. As Federal 1691 #10-8 has been plugged and abandoned, it will not count toward the above well limit. In addition, the six coalbed methane wells originally permitted by North Finn LLC and drilled in Section 5, T. 17 N., R. 90 W., and the well located in Section 36 of T. 15 N., R. 91 W., will not count toward the allowed well number, as long as they are not included as part of any proposed pod. In addition, required injection wells and monitoring wells will not count toward the well limit.

4. Any modifications proposed to the approved pods (i.e. changing pod locations, drilling wells outside of the current pod locations, or increasing the total number of wells allowed during interim drilling), will only be approved if geologic, hydrologic, or reservoir characteristics support a change. These changes will be allowed after review by, and concurrence of, the Reservoir Management Group and authorization by the BLM, Rawlins Field Office. Additional federal drainage protection wells may be required.

5. During preparation of the EIS, coalbed methane wells and associated roads and pipelines on any private surface/private mineral where the operator has, or has obtained legal access (i.e., county roads, approved BLM ROW grant or private access road) prior to approval of the interim drilling plan, may be developed as deemed appropriate by the operator/lessee. However, these wells will count toward the total number of wells allowed to be drilled under this interim drilling policy.

THE FOLLOWING CRITERIA AND CONDITIONS APPLY TO INTERIM DRILLING OPERATIONS

1. A detailed Plan of Development/Surface Use Plan (POD/SUP) and Master Drilling Plan for each individual pod, using guidance provided by the BLM Rawlins Field Office, will be submitted and approved prior to surface disturbing activities.

2. The operator(s) agree to supply the geologic, coal, and water data information discussed in Attachment 1 of this document.

3. Prior to initiating interim drilling, an environmental assessment (EA), including a detailed Water Management Plan will be prepared and approved for each individual pod. Because of the current BLM workload, and in order to expedite the completion of the EAs, it is recommended that these documents be prepared by a third-party contractor.

4. All pod EA's will be submitted to the BLM in pdf format and each document will be placed on the BLM Wyoming web page. A 30-day public review of each document will be occur from the date the document is placed on the site. BLM will be responsible for writing the Decision Record for each EA.

5. A 1/4 mile buffer is required between surface disturbing activities and the Overland Trail.

6. Block surveys for cultural resources will be required for each pod.

7. No interim drilling will be allowed in the Sand Hills Area of Critical Environmental Concern as described in the Great Divide Resource Management Plan Record of Decision (RMP-1990).

8. The Great Divide RMP states the BLM will include intensive land-use practices to mitigate salt and sediment loading caused by surface disturbing activities within the Muddy Creek watershed. The Muddy Creek Coordinated Resource Management (CRM) group was established as an advisory group to address this issue. Because this area overlaps with the Muddy Creek CRM effort, and since road use contributes the most in increasing the amount of sediment in the Muddy Creek drainage, the POD/SUP will be reviewed by the Muddy Creek CRM Road Committee and recommendations of the group will be considered by BLM. Changes to the POD/SUP will be made prior to initiating work on the pod EA.

9. Surface discharge as a method of disposal for produced coalbed methane waters will be considered for each individual pod during interim drilling activities within the Great Divide Basin. This is subject to the approval of the Water Management Plan and upon obtaining all required federal, state and local permits.

10. Prior to completion of the EIS, water produced from coalbed methane wells located in the Colorado River Basin will be disposed of by re-injection. The only exception to this would be waters produced from the Double Eagle's coalbed methane existing and proposed wells located in the Cow Creek POD (POD #6). Double Eagle has applied to the Wyoming Department of Environmental Quality (WDEQ) for a National Pollutant Discharge Elimination System (NPDES) permit for their two existing wells and four wells permitted recently by BLM. Should Double Eagle receive their state permit, they will be allowed to surface discharge from these six wells. Prior to any additional drilling of CBM wells by Double Eagle in POD#6, an environmental assessment, including a Water Management Plan, will be prepared and submitted to BLM which will examine the environmental impacts from these wells. Double Eagle will be allowed to dispose of produced CBM waters to the surface only after completion of the environmental analysis and a determination is made that the additional surface discharge will cause no significant impact to the environment.

11. No drilling activities will be allowed in prairie dog towns during interim operations. However, drilling will be allowed in each individual pod containing prairie dog towns upon the completion of black-footed ferrets survey using methods approved by the United States Fish and Wildlife Service. These surveys will clear the pod for a one year period.

The operators also have the option of completing surveys in the whole EIS area which would clear the area for the life of the project.

12. In the event a black-footed ferret or its sign is found, the BLM Authorized Officer shall stop all action on the application in hand, and/or action on any application that may directly, indirectly, or cumulatively affect the colony/complex, and initiate Section 7 review with the USFWS. No project related activities will be allowed to proceed until the USFWS issues their biological opinion. The USFWS biological opinion will specify when and under what conditions and/or prudent measures the action could proceed or whether the action will be allowed to proceed at all.

13. No drilling or disturbance will be allowed in those areas determined to be critical winter habitat for sage grouse.

14. No drilling or disturbance will be allowed in areas where any two or more big game (elk, deer, or antelope) crucial winter ranges overlap.

15. The operators will be required to submit a drilling schedule as part of the Master Drilling Plan. This schedule will be reviewed, and approved by BLM, to ensure that activities are limited within proven big game migration corridors at critical use times during the year.

16. Pipelines, power lines, waterlines, fiber optic lines will be buried and, where possible, will follow the road rights-of-way.

17. Fish passage structures will be installed for roads which cross drainages with fisheries concerns as identified by BLM.

TERM DEFINITIONS

SENSITIVE RESOURCE AREAS are defined as those areas containing stabilized sand dunes, sensitive plant areas, raptor nesting concentration areas, prairie dog towns, two-mile buffer around sage grouse leks, mountain plover aggregation areas or potential habitat, big game migration corridors and crucial big game winter ranges, and areas with high density cultural or paleontological resource sites. Field inspections by the BLM will be conducted to verify presence of these resource values and potential impacts prior to considering authorization of any proposed development activity on Federal surface and/or minerals.

WILL BE AUTHORIZED means BLM will authorize the action if, following the environmental review of the APD or ROW application, sensitive resource areas are protected with appropriate stipulations or mitigation and the criteria established under CEQ regulation 40 CFR 1506.1 have been met. An environmental assessment (EA) will be completed for each individual pod prior to authorizing the proposal. Consultation and Coordination with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service will occur when applicable for proposed activity within sensitive resource areas. The pod EA will identify the most environmentally acceptable access route, well site, and pipeline location. Mitigation measures developed from nearby project EISs and EAs for protection of resource values may be considered in the assessment. Any action proposed must be in conformance with the Great Divide Resource Management Plan (RMP) and mineral lease terms and conditions.

A coalbed methane pod may consist of two or more production wells, injection wells, access roads, product pipelines, water pipelines, power lines and other ancillary facilities designed specifically to assess the development potential of the play.

ATTACHMENT 1
DATA SUBMISSION REQUIREMENTS

A. GEOLOGIC AND COAL INFORMATION REQUIRED TO BE SUBMITTED BY OPERATORS DURING INTERIM DRILLING ACTIVITIES

The geologic and coal information needs identified below are those that the Reservoir Management Group, in consultation with the United States Geologic Survey, has determined are needed based on their experience with coalbed methane development in the Powder River Basin. The information will be used to define the potential gas resource and provide valuable data for the NEPA assessment including the determination of future development potential.

1. Operators will provide copies of all geologic information obtained to the Rawlins Field Office and the Reservoir Management Group as required under 43 CFR 3162.4.

2. The suite of logs required to evaluate coal beds in the project area are high resolution gamma ray, resistivity, density, and neutron logs. The full suite will be required during this phase but may be reviewed for changes during any later drilling phase.

3. Detailed geologic and coal information will be required and obtained for a minimum of one well within each of the nine pods. Information required includes; coal cores, fluid level, and production analysis. From this data information can be obtained on coal rank, adsorption and desorption gas content, core density, specific gravity, orientation of cleats and joints, initial saturations, coal permeability, and desorption pressure.

4. Initial reservoir pressure for each pod drilled.

5. Agree to standard stratigraphic nomenclature for all operators to use in preparing reports to the BLM and Wyoming Oil and Gas Conservation Commission.

6. Obtain an initial reservoir pressure for each coal bed in three of the pods.

7. Obtain reservoir pressure at the end of one year and two years, for each coal bed in three of the pods.

B. WATER ASSESSMENT/MONITORING DATA NEEDS

Recognizing that surface and ground water resources can be affected by large coalbed methane drilling projects, the following data submission requirements will be necessary to complete the assessment of impacts and develop baseline water conditions. Also water monitoring data has been found to be vital when reviewing drainage situations.

1. The operator(s) will obtain aquifer hydraulic baseline data for all pods in the initial exploration phase. This will include hydraulic conductivity and storativity derived from a multiple well pumping test conducted at each pod. This information could be used to provide data for the NEPA document and to assess monitoring needs for full field development.

2. Identify all domestic/industrial wells in the area and make a baseline and annual measurement of each.

3. Prepare a well mitigation agreement for existing wells and offer it to all groundwater appropriators in the vicinity.

4. Monitoring wells need to be installed both in an updip and downdip direction, completed in coal and overburden, from the pods selected. Details of this requirement will be done in coordination with the Rawlins Field Office hydrologist.

5. Measure initial static water levels in all production wells.

6. Collect water quality analyses for each pod.

7. Each well must have a continuous flow meter installed to measure water production rates for the duration of the project. All water production data will be furnished to the Bureau.

8. Baseline surface water quality should be collected in each stream or receiving water that will collect or transport discharge water. The analysis will include all BLM category I, II and III constituents.

9. The operator will provide to BLM a geologic map of the area/watershed where the produced water is to be re-injected. This should include surficial and bedrock geology, with a clear definition of recharge zones of the receiving formation/unit. The pre-injection water levels and water quality should be monitored and that data provided to BLM. The receiving aquifer should be pump tested and aquifer hydraulics reported to BLM. The reported parameters will include hydraulic conductivity, water levels and storativity for each receiving aquifer.

C. Additional Water Monitoring Requirements.

The following requirements were added to the interim drilling requirements effective January 14, 2002. Where there are conflicting monitoring requirements with those described in part B of this attachment, those listed below will supercede the previous requirements.

1. One pod in each distinct geologic setting will be selected for monitoring reservoir pressures with the required monitoring well program. The location of wells used in monitoring reservoir pressures will be determined through discussion with, and approval by, the Reservoir Management Group and the Rawlins Field Office.

2. One monitoring well will be drilled in each of the three selected pods which will allow all of the necessary data to be developed and available.

3. Take pressure reading from these wells every other month for the first year and then quarterly, or on a time frame as determined by the Resource Management Group. Data collected in each interval of the multiple completion groundwater monitoring well shall include an initial four-hour, formation-pressure measurement for each perforated interval. Subsequent, periodic pressure measurements for each perforated interval will be of at least a two-hour duration unless the interval has been open for more than two hours or if pressure buildup or decline suggest a different time interval.

4. Use of one of the proposed production wells to monitor reservoir pressure of the coal by obtaining initial pressure and annual shut-in bottom hole pressures.

This interim drilling policy is current as of a January 14, 2002. The activities, criteria, and conditions under which interim drilling are allowed are subject to change.

APPENDIX B

ATLANTIC RIM NATURAL GAS PROJECT RECLAMATION PLAN

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APPENDIX B

ATLANTIC RIM NATURAL GAS PROJECT AREA RECLAMATION PLAN

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APPENDIX B

ATLANTIC RIM NATURAL GAS PROJECT AREA RECLAMATION PLAN

1.0 INTRODUCTION

The following erosion control, revegetation, mitigation, and management measures are designed to attain successful reclamation of disturbed areas associated with the Atlantic Rim Natural Gas Project Area (ARPA). These measures are designed to establish the feasibility of reclaiming disturbances associated with this project. The measures were developed based on: (1) Bureau of Land Management (BLM) Wyoming State Office reclamation policy (USDI-BLM 1990a); (2) management directives presented in the Great Divide RMP (USDI-BLM 1990b); (3) Wyoming Department of Environmental Quality, Land Quality Division reclamation guidelines, (4) impacts identified in the Environmental Consequences chapter (Chapter 4) of this environmental impact statement (EIS); (5) coordination with BLM staff; and (6) issues identified during the scoping process.

The extent of possible disturbed areas to be reclaimed include the drill pad sites, staging areas, access road and pipeline right-of-ways (ROWs). The following measures apply to the Proposed Action and to the No Action Alternative. The measures presented in this plan are designed to minimize the project's impacts to natural resources. Because of the large geographic area covered by the project and the lack of site-specific locations of project facilities, these measures are presented in a general, non-specific manner. Final selection of the measures to be applied at any given location, and modifications of these measures, will be identified by the BLM in coordination with the Operators.

This reclamation plan outlines measures that will be taken to effectively reclaim areas disturbed during the construction phase of the proposed project. These measures will be followed unless exceptions are granted or actions are modified by agreement between the BLM and the Operators. These measures describe how natural gas development activities should be managed to assure compliance with the resource management goals and objectives for the general area, applicable lease and unit area stipulations, and resource limitations identified during interdisciplinary team (IDT) analyses. Initial monitoring for compliance and successful implementation of the mitigation measures will be under the direction of the Operators. Final approval and release will be under the direction of the BLM.

Reclamation measures covered in this plan fall into two general categories: temporary and final reclamation. Temporary reclamation refers to measures applied to stabilize disturbed areas and to control runoff and erosion during time periods when application of final reclamation measures is not feasible or practicable. Final reclamation refers to measures that are to be applied concurrently with completion of drilling and pipeline installation.

Reclamation potential may be limited by soil chemical characteristics (e.g., salinity, alkalinity), physical characteristics (e.g., texture classification), altitude, aspect, slope, shallow soils, depth to bedrock, precipitation zone, length of growing season and seasonably high water tables. Special intensive land-use practices may be necessary to mitigate salt and sediment loading caused by surface-disturbing activities within the project area. Activity plans (e.g., applications for permit to drill [APDs]) should address site-specific issues and potential problems, including monitoring for salt and sediment loading (USDI-BLM 1990b).

In general, temporary reclamation measures should be applied to all areas that cannot be promptly reclaimed to final conditions within a specified time period whether due to adverse weather conditions, inability to secure needed materials, and/or seasonal constraints, etc.

Temporary reclamation measures should be applied only as needed; as in most cases, final reclamation measures should be applied concurrently as sections of the project are completed. Temporary reclamation measures may be applied more rigorously to sensitive areas such as drainage channel crossings, steep slopes, and areas prone to high wind and water erosion. Temporary reclamation measures should include re-grading the disturbed area to near pre-disturbance contour, re-spreading salvaged topsoil, mulching, and placement of runoff and erosion control structures.

Final reclamation measures, in general, involve re-grading the disturbed area to near pre-disturbance contour, re-spreading salvaged topsoil, applying soil amendments (if necessary), seeding a BLM-approved seed mixture, mulching, and placing runoff and erosion control structures such as water bars and silt fences. The duration of the resultant impacts to the various vegetation community types depends in part on the success of implementation of the reclamation measures prescribed in this plan and the time required for primary succession to return disturbed areas to pre-disturbance vegetation conditions.

Most of the surface water features in the project area qualify as Waters of the United States. Channels that carry surface flows and that show signs of active water movement are classified as waters of the U.S. Similarly, all open bodies of water (except ponds and lakes created on upland sites and used exclusively for agricultural and industrial activities or aesthetic amenities) are Waters of the U.S. [EPA 33 CFR § 328.3(a)] and are regulated by the Army Corps of Engineers (ACOE). Many ephemeral drainage channels identified on the USGS topographic maps for the ARPA are vegetated swales and are not considered to be Waters of the U.S. (ACOE 1987, 1992).

Any activity that involves discharge of dredge or fill material into or excavation of "Waters of the U.S." is subject to regulation by the ACOE pursuant to Section 404 of the Clean Water Act (CWA). The ACOE, based on the exact nature of the disturbance activity will determine the type of permit (Individual, Regional, or Nationwide) required according to the rules and regulations stated in the Federal Register (1986). Avoidance of Waters of the U.S. and wetlands should be a high priority. A suitable wetland mitigation plan should be developed for the areas of wetlands directly impacted due to project activities where avoidance is not practicable. Impact minimization should include reducing the area of disturbance in wetland areas as well as utilizing procedures specified by authorizing agencies to cross intermittent and ephemeral drainage channels and wetland areas. Activities that modify the morphology of stream channels are also subject to regulation by the Wyoming Department of Environmental Quality (WDEQ).

Residual wetland impacts that could occur after maximum avoidance and/or impact minimization have been demonstrated should be mitigated according to the following order of priority: (1) avoidance; (2) impact minimization; (3) mitigation in-kind, on-site; (4) mitigation in-kind, off-site; (5) mitigation out-of-kind, on-site; and (6) mitigation out-of-kind, off-site. In addition, the following modes of mitigation could be implemented for wetland mitigation if avoidance and impact minimization were not feasible: (1) wetlands restoration; (2) wetlands creation; and (3) wetlands enhancement. The wetlands mitigation plan should be designed to replace the area of impact and functional values associated with the disturbed area.

Appropriate BLM, Natural Resources Conservation Service (NRCS) range conservationists, and private seed companies were contacted to determine seeding recommendations at drill sites and along access road and pipeline ROWs. The reclamation measures in this report assume that baseline data (see Methods) will be collected at appropriate sites along the proposed access road and pipeline ROWs, staging areas, drill sites, and other potential construction-

related disturbed areas prior to construction by a qualified and authorized Operator representative.

Other criteria used in the seed mixture selection process included:

1. Seed availability and price, growth form, seasonal variety and prevailing dominant species;
2. contain no fewer than four (4) herbaceous species, unless a proposed land use (e.g. managed hayland or pastureland) requires fewer species;
3. contain the native dominant herbaceous species which support the post-disturbance land uses;
4. if needed, contain additional species native to the region which support the post-disturbance land uses;
5. contain naturalized, introduced species only if additional herbaceous species are needed, or if suitable, native species are unavailable or if naturalized species are superior for a specialized land use (e.g. managed hayland or pastureland);
6. contain full shrub and/or subshrub species when these species will support the post-disturbance land uses; and
7. contain native forb species if natural reestablishment of forbs will be limited by site-specific conditions.

2.0 OBJECTIVES

This plan is designed to meet the following objectives for reclamation of the access road/pipeline ROWs, staging areas, and the drill sites:

Short-Term (Temporary) Reclamation:

- Immediately stabilize the disturbed areas by mulching (if needed), providing runoff and erosion control, and through the establishment of new vegetation (required for problem areas; may be optional for other areas depending on consultation with the BLM).

- Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.

Long-Term (Final) Reclamation:

- Stabilize the disturbed soil surface by mulching (if needed and as directed by the BLM), runoff and erosion control, and through the establishment of new vegetation. Adequate surface roughness should exist to reduce runoff and to capture rainfall and snow.

- Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.

- Restore primary productivity of the site and establish vegetation that will provide for natural plant and community succession.

- Establish a vigorous stand of desirable plant species that will limit or preclude invasion of undesirable species, including noxious/invasive species.

- Reseed the disturbed areas with native plant species useful to wildlife and livestock.

- Enhance aesthetic values. In the long-term, reclaimed landscapes should have characteristics that approximate the visual quality of adjacent areas, including location, scale, shape, color, and orientation of major landscape undisturbed features.

3.0 PERFORMANCE STANDARDS

The following performance standards should be used to determine the attainment of successful revegetation:

All Years:

- Protective cover. With the exception of active work areas, all disturbed highly erosive or sensitive areas to be left bare, unprotected, or un-reclaimed for more than one month will have at least a 50 percent cover of protective material in the form of mulch, matting, or vegetative growth. All disturbed areas should have at least a 50 percent cover of protective material within six months after reclamation.

Second Year (Final Reclamation):

- Seedling density. The density and abundance of desirable species is at least three to four seedlings per linear foot of drill row (if drilled) or transect (if broadcast). Permanent vegetation transects will be established so that repeatable measurements can be conducted annually through the five year monitoring period.

- Percent cover. Total vegetal cover will be at least 50 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

By the Fifth Year (Final Reclamation):

- Percent cover. Total vegetal cover will be at least 80 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

- Dominant species. Ninety percent of the revegetation consists of species included in the seed mix and/or occurs in the surrounding natural vegetation, or as deemed desirable by the BLM as measured along the reference transect for establishing baseline conditions.

- Erosion condition/soil surface factor. Erosion condition of the reclaimed areas is equal to or in better condition than that measured for the reference transect for establishing baseline conditions.

4.0 METHODS

4.1 Drill Site, Access Road, and Pipeline Right-of-Way Clearing and Topsoil Removal and Storage

Topsoil should be handled separately from subsoil materials. At all construction sites, topsoil should be stripped to provide for sufficient quantities to be respread to a depth of at least four to six inches over the disturbed areas to be reclaimed. In areas where deep soils exist (such as floodplains and drainage channel terraces), at least 12 inches of topsoil should be salvaged.

Where soils are shallow or where subsoil is stony, as much topsoil should be salvaged as possible. Topsoil should be stockpiled separately from subsoil materials. Topsoil salvaged from drill sites and stored for more than one year should be bladed to a specified location at these areas, seeded with a prescribed seed mixture, and covered with mulch for protection from wind and water erosion and to discourage the invasion of weeds. Topsoil stockpiles should not exceed a depth of two feet. Topsoil should be stockpiled separately from other earth materials to preclude contamination or mixing and should be marked with signs and identified on Construction and Design plans. Runoff should be diverted around topsoil stockpiles to minimize erosion of topsoil materials. In most cases, disturbances will be reclaimed within one year. Therefore, it is unlikely that topsoil stockpiling for more than one year will be required. Salvaged topsoil from roads and drill sites will be respread over cut-and-fill surfaces not actively used during the production phase. Upon final reclamation at the end of the project life, topsoil spread on these surfaces will be used for the overall reclamation effort.

Operators are finding out that it is not always necessary to remove all vegetation and strip all topsoil within a pipeline ROW. In many areas, such as with deep soils on relatively flat smooth slopes with low gradients, it is possible to crush in-place rather than clear vegetation and leave topsoil in-place rather than blade and stockpile. This technique would reduce the magnitude and severity of disturbance impacts and hasten successful reclamation.

In federal jurisdictional wetland areas, vegetation should be cut off only to the ground level, leaving existing root systems intact. Cut vegetation should be removed from wetland areas for disposal. Grading activities should be limited to directly over pipeline trenches and access roads. At least 12 inches of topsoil should be salvaged and replaced except in areas with standing water or saturated soils. Use of construction equipment in wetland areas should be limited. Dirt, rockfill, or brush riprap should not be used to stabilize pipeline ROWs. If standing water or saturated soils are present, wide-track or balloon-tire construction equipment should be used or normal construction equipment should be operated on equipment pads or geotextile fabric overlain with gravel fill. Equipment pads etc., should be removed immediately upon completion of construction activities. Trench spoil should be placed at least 10 feet away from drainage channel banks for all minor and major drainage channel crossings.

4.2 Drill Site, Access Road, and Pipeline Right-of-Way Construction

4.2.1 Upland Areas

Uplands include all areas away from wetlands and alluvial bottomlands or other areas that have excess soil moisture for prolonged periods or have shallow water tables. Construction should be accomplished following site-specific Construction and Design plans and applicable agency specifications. At drill sites, and along the areas of access road or pipeline ROW traversing steep slopes, slope angles should be minimized to enhance retention of topsoil, and reduce erosion as well as facilitate revegetation and subsequent reclamation success. Slope stabilizing revetment structures may be necessary in areas where the substrata materials are unconsolidated and loose and cannot be stabilized with revegetation and mulch.

Surface runoff should be controlled at all well sites through the use of interception ditches and berms. A berm approximately 18 inches high should be constructed around fill portions of these well sites to control and contain all surface runoff generated or fuel or petroleum product spills on the pad surface. Water contained on the drill pads should be treated in a detention pond, prior to discharge, into undisturbed areas in the same manner as discussed previously. This system should also serve to capture fuel and chemical spills, should they occur.

Erosion and sedimentation control measures and structures should be installed on all disturbed areas. Soil erosion control should be accomplished on sites in highly erosive soils and steep areas with mulching, netting, tackifiers, hydromulch, matting, and excelsior. The type of control measure should depend on slope gradients and the susceptibility of soil to wind and water erosion. Silt fences should be placed at the base of all steep fill slopes and sensitive disturbed areas. All runoff and erosion control structures should be inspected periodically, cleaned out, and maintained in functional condition throughout the duration of construction and drilling. Water bars should be constructed on cut-and-fill slopes exceeding 25 feet long and 10 percent gradient using the water bar spacing guidelines and procedures specified for access road and pipeline ROW runoff and erosion control (BLM Manual 9113).

Runoff and erosion control along access road/pipeline ROWs should be accomplished by implementing standard cross drain, culvert, road ditch, and turnout design as well as timely mulching and revegetation of exposed cut, fill, and road shoulders. All culverts should be constructed with riprapped entrances and exits and with energy dissipaters or other scour-reducing techniques where appropriate. Water discharged from culverts, cross drains, road ditches and turnouts should be directed into undisturbed vegetation away from all natural drainages. Erosion and sedimentation control measures and structures should be installed across all cut-and-fill slopes within 100 feet of drainage channels. All runoff and erosion control structures should be inspected after major runoff events and at a regular schedule. If found to be sub-standard, these structures should be cleaned out and maintained in functional condition throughout the life of the project.

4.2.2 Drainage Channel Crossings

Construction of drainage channel crossings should minimize the disturbance to drainage channels and wetlands to the extent practicable and should occur during the low runoff period (June 15 through March 1). Staging areas should be limited in size to the minimum necessary and should be located at least 50 feet from drainage channel bottoms, where topographic conditions permit. Hazardous materials should not be stored and equipment should not be refueled within 100 feet of drainage channels. Drainage channel crossings should be constructed as perpendicular to the axis of the drainage channel and at the narrowest positions as engineering and routing conditions permit. Clean gravel should be used for the upper one foot of fill over the backfilled pipeline trenches within drainage channel crossings.

4.2.3 Wetlands

Access roads and pipelines should be rerouted, and drill sites located, to avoid wetland areas to the maximum extent practicable. The size of staging areas should be limited to the minimum necessary and all staging areas should be located at least 50 feet from the edge of federally delineated wetland areas, where topographic conditions permit. The width of the access road and pipeline construction ROW should be limited to no more than 50 feet. Hazardous materials should not be stored and equipment should not be refueled within 100 feet of wetland boundaries.

4.3 Surface Runoff and Erosion Control

4.3.1 Drill Site, Access Road, and Pipeline Right-of-Way

4.3.1.1 Temporary Reclamation

Temporary erosion control measures may include application of mulch and netting of biodegradable erosion control blankets stapled firmly to the soil surface, respreading scalped vegetation, or construction of water bars. See Final Reclamation measures (Section 4.6) for specific information pertaining to mulching.

The actual distance of a pipeline/road ROW requiring stabilization on each side of a drainage channel should be determined on a site-specific basis. To minimize sedimentation of drainage channels and wetlands during the interim period between construction activity and final reclamation, temporary erosion and sediment control measures should be applied. Silt fences or other sediment filtering devices such as weed-free straw bales should be installed along drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetlands. Figure C-1 presents schematics of water bar and silt fence construction. Sediment filtering devices should be cleaned out and maintained in functional condition throughout the life of the project. To avoid the possibility of mulching materials entering waterways, loose mulch (i.e., mulch not crimped into the soil surface, tackified, or incorporated into erosion control blankets) should not be applied to drainage channel banks.

If construction is completed more than 30 days prior to the specified seeding season for perennial vegetation, areas adjacent to the larger drainage channels should be covered with jute matting for a minimum of 50 feet on either side of the drainage channel. In addition, to protect soil from raindrop impact and subsequent erosion, 2.0 tons/acre of weed-free straw mulch should be applied to all slopes greater than 10 percent. Temporary erosion control measures may include leaving the ROW in a roughened condition, respreading scalped vegetation, or applying mulch. As indicated by several operators and the BLM, weed-free straw mulch is difficult to obtain in quantities and at costs suitable for all reclamation applications. Although this circumstance could reduce the application of the measure, the effectiveness of mulch in protecting the exposed soil from raindrop impact, erosion, and off-site sedimentation should not be ignored. In addition to its effectiveness in erosion control, mulching also benefits the soil as a plant growth medium in many cases. Therefore, effective mulching is fundamental to reducing soil erosion to acceptable, non-significant levels.

Trench breakers should be used for pipeline construction in certain areas to prevent the flow of water in either a trench that has been backfilled or temporarily left open. Trench breakers are particularly important in wetland areas to minimize subsurface drainage. Trench breakers should be constructed such that the bottom of one breaker is at the same elevation as the top of the next breaker down slope, or every 50 feet, whichever is greater. Factors that control the application of trench breakers include the proximity to drainage channels and wetland areas, slope gradient, proximity of areas to shallow groundwater, and surface runoff source areas that can discharge water into the trench. Trench breakers should be installed, where necessary. Topsoil should not be used to construct trench breakers.

If a pipeline crosses roads at the base of slopes, vegetative strips should be maintained. If vegetation is disturbed within these limits, temporary sediment barriers such as silt fences and/or staked weed-free straw bales should be installed at the base of the slope adjacent to the road crossing. Temporary sediment barriers should remain in-place until permanent revegetation measures have been judged successful.

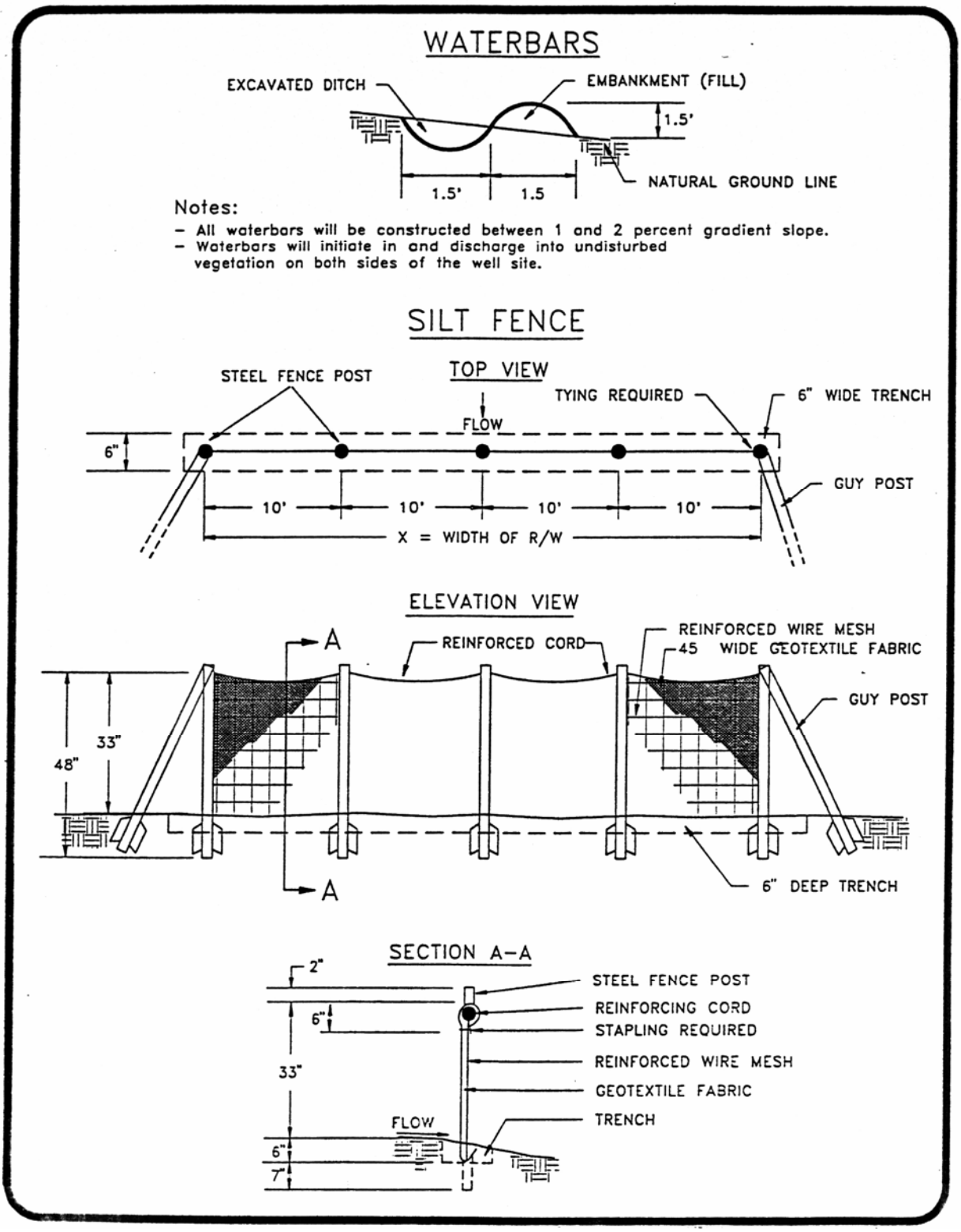

Figure C-1. Water Bar Construction and Silt Fence Construction.

4.3.1.2 Final Reclamation

4.3.1.2.1 Upland Areas

Runoff and erosion control along all ROWs should be accomplished by constructing sediment trapping devices (e.g., silt fences and straw bales) and water bars, as well as by timely mulching and revegetation of exposed disturbed areas. Runoff discharged from water bars should be directed into undisturbed vegetation away from all natural drainages. Erosion and sedimentation control measures and structures should be installed across all cut-and-fill slopes. All runoff and erosion control structures should be inspected after major runoff events and on a regular schedule. If found to be substandard or ineffective, these structures should be cleaned out and maintained in functional condition until successful revegetation and soil stability is attained.

Water bars should be constructed across sideslopes at appropriate intervals according to slope gradient immediately following recontouring of the disturbed areas. The spacing should depend on whether mulching is applied in conjunction with placement of water bars. Water bars should be maintained in functional condition throughout the life of the project. Should the integrity of the water bar system be disrupted during seeding, water bars should be repaired and broadcast seeded with the seed raked into the soil. Water bars should be constructed according to hillslope topography at the slope gradient intervals as shown in Table C-1.

Water bars should be constructed 12 to 18 inches deep by digging a small trench and casting the soil material to the downhill side in a row. Each water bar should initiate in undisturbed vegetation upslope, traverse the disturbed area perpendicular to the ROW at a gradient between one and two percent, and discharge water into undisturbed vegetation on the lower side of the disturbed area.

Table C-1. Water Bar Intervals According to Slope Gradient[1].

With Mulching		Without Mulching	
Slope Gradient (percent)	**Interval (feet)**	**Slope Gradient (percent)**	**Interval (feet)**
10	150	10	100
15	100	15	75
20	50	20	45
30	40	30	40
40	35	40	35
50	30	50	30
>50	30	>50	30

[1] Based on Grah (1989)

4.3.1.2.2 Wetlands and Drainage Channel Crossings

Disturbance to ephemeral and intermittent drainage channels should be avoided and/or minimized. All channel crossings not maintained for access roads should be restored to near predisturbance conditions. Drainage channel bank slope gradients should be regraded to conform with adjacent slope gradients. Channel crossings should be designed to minimize

changes in channel geometry and subsequent changes in flow hydraulics. Culverts should be installed for ephemeral and intermittent drainage channel crossings. All drainage channel crossing structures should be designed to carry the 25- to 50-year discharge event as directed by the BLM. Silt fences should be constructed at the base of slopes at all drainage channel crossings. Minor routing variations should be implemented during access road, pipeline, and drill site layout to avoid washes. The area of disturbance in the vicinity of washes should be minimized. Per the Great Divide Resource Area Resource Management Plan (RMP), a 500-foot-wide buffer strip of natural vegetation should be maintained between all construction activities and drainage channels.

Trench plugs should be employed at non-flumed drainage crossings to prevent diversion of drainage channel flows into upland portions of pipeline trenches during construction. Application of riprap should be limited to areas where flow conditions prevent vegetative stabilization; riprap activities must comply with ACOE permit requirements. Pipeline trenches should be dewatered in such a manner that no silt-laden water flows into active drainage channels (i.e., prior to discharge the water should be filtered through a silt fence, weed-free straw bales, or allowed to settle in a sediment detention pond).

4.4 Baseline Vegetation and Soil Inventory

Success of final revegetation goals is best determined by comparison with pre-disturbance conditions. The following recommendations are presented to assist the Operators (or designated agent) to collect the necessary data. During the APD process, exact disturbance locations are identified, described, and mapped. A baseline inventory of the vegetation on these locations will be conducted prior to the beginning of construction activities.

1. During the baseline inventory, the applicant delineates portions of vegetation types which will remain undisturbed and which are representative, in terms of physiography, soils, vegetation and land use history, of the plant community affected by soil disturbance activities. These undisturbed sites will serve as comparison sites for disturbed site impacts and final revegetation success. The representative nature of the comparison site is verified by statistical comparison (confidence level of 90%, $\alpha = 0.1$) of its absolute values of % vegetation cover, % total ground cover and total herbaceous production to similar data from the plant community it typifies. Species composition and species diversity are subjectively (non-statistically) evaluated. Quantitative pre-disturbance vegetation data from the reference site are directly compared, by standard statistical procedures (confidence level of 80%, $\alpha = 0.2$), to data from a reclaimed vegetation type when evaluating revegetation success. No mathematical climatic adjustment is made. Qualitative data are compared by standard procedures agreed to by the Operators and BLM.

2. During the baseline inventory, standard sampling methods are used to estimate the pre-disturbance values of the vegetation parameters on each affected vegetation type and an undisturbed portion of the same vegetation type. These pre-disturbance data are used to document the representative nature of the undisturbed unit. General inventory procedures, detailed quantitative sampling procedures, and estimating adequate sample size can be accomplished using several time-tested methods (USDI-BLM 1996, WDEQ 1984).

3. To assist in formulating a final revegetation seed mix, a plant species list will be constructed beginning with the baseline inventory. Field checks will be performed during June and August to ensure annual forbs are recorded (June) and late-maturing perennial grasses are correctly identified (August). Special attention should be given to identifying and recording the location of

all plant species of special concern, noxious/invasive weeds, and selenium indicator plants. *Artemisia* taxa will be identified to sub-specific level.

4. An adequate number of soil samples should be taken in each vegetation type encountered during the baseline survey. The seed mixtures shown in Table C-2 are based upon soil physical and chemical properties and it is imperative that the correct seed is matched to the parent soil to enhance revegetation success. Soil samples should be analyzed by an authorized soil testing laboratory for pH, soluble salts, organic matter, nitrate nitrogen, phosphorus, potassium, zinc, iron, copper, manganese, lime and soil texture. An additional test to determine the sodium adsorption ratio (SAR) may be required in questionable soils.

5. At least two (2) years prior to the end of the 5-year period, the revegetation success parameters are again estimated on the revegetated areas and the undisturbed units.

4.5 Noxious/Invasive Weed Management

On 3 February 1999, Executive Order (EO) 13112 ("Invasive Species") was signed by President Clinton. The primary purpose of this EO is to prevent the introduction of invasive species and provides for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. In Wyoming, some 428 species have been documented as invasive (Hartman and Nelson 2000). Of these 428 plants, 24 are designated as noxious by the State of Wyoming (Rice 2004) and are shown in Chapter 3 of this EIS (Table 3-26). In addition to these 24 state-designated species, Carbon County has designated halogeton (*Halogeton glomeratus*), plains prickly pear (*Opuntia polycantha*), Geyer larkspur (*Delphinium geyeri*), and lupine (*Lupinus* spp.) as noxious (Justensen 2004).

The presence, distribution, and density of noxious/invasive weeds on the project area will be monitored by the Operators. The well access roads, well pads, staging areas, and other project related soil disturbances will be inspected regularly to ensure that noxious/invasive weeds do not become established on newly disturbed sites. Control methods will be based on available technology, taking into consideration the weed species present. Methods of noxious/invasive weed control may include prompt revegetation of disturbed sites to reduce the potential for weed invasion, mowing, hand-pulling, or application of appropriate registered herbicides. The control methods shall be in accordance with guidelines, rules, laws, and regulations established by the Environmental Protection Agency (EPA), BLM (1991), and state/local authorities and agencies. Prior to initiating a weed management program, the Operators will obtain written approval from the BLM Authorized Officer. The Operators will also prepare and submit a proposal and plan to the BLM Authorized Officer for an annual weed program that satisfies the requirements established in the MSUP and any additional Conditions of Approval.

A concentrated effort will be required to manage the rapid invasion and expansion of halogeton (*Halogeton glomeratus*) that has occurred on much of the project area during the 2003 and 2004 growing seasons. Halogeton, an annual plant, is an aggressive invader of newly disturbed sites with alkaline to saline soils. Plant tissues accumulate salts from lower soil horizons. The salts leach from dead plant material, increasing topsoil salinity and favoring halogeton seed germination and establishment. Some salt in the foliage consists of soluble oxalates toxic to livestock, especially sheep. The threat of this plant to the livestock industry resulted in the Halogeton Glomeratus Act of 1952 (7 USC, Chapter 40, §§ 1651-1656). In addition to poisoning livestock, the ecological threats posed by the establishment of halogeton on the ARPA include: degradation of wildlife and livestock habitat; an increased salt load in the Upper Colorado River System; and reduction of native plant diversity and abundance.

Table C-2. Recommended General Seed Mixes for Disturbed Land Areas on the Atlantic Rim Natural Gas Project Area.

Plant Species	Scientific Name	Variety (if applicable)	Recommended Drill Seeding Rate[A]	Recommended Broadcast Seeding Rate[A]
SALINE/SODIC SOILS				
Western wheatgrass	*Pascopyrum smithii*	'Rosanna' or 'Arriba'	4.0	8.0
Sandberg bluegrass	*Poa secunda*		1.0	2.0
Slender wheatgrass	*Elymus trachycalum*	'Revenue' or 'Prior'	2.0	4.0
Indian ricegrass	*Achnatherum hymenoides*	'Nezpar' or 'Rimrock'	3.0	6.0
Bottlebrush squirreltail	*Elymus elymoides*		1.0	2.0
Alkali sacaton	*Sporobolus airoides*	'Salado'	0.75	1.5
Inland saltgrass	*Distichlis spicata*		1.0	2.0
Gardner's saltbush	*Atriplex gardneri*		2.0	4.0
Shadscale	*Atriplex confertifolia*		2.0	4.0
TOTAL			16.75	33.5
WETLAND/HIGH WATER SOILS				
Tufted hairgrass	*Deschampsia caespitosa*	'Nortran'	4.0	8.0
Basin wildrye	*Leymus cinereus*	'Trailhead' or 'Magnar'	6.0	12.0
American sloughgrass	*Beckmannia syzigachne*	'Egan'	3.0	6.0
Bluejoint reedgrass	*Calamagrostis canadensis*	'Sourdough'	1.0	2.0
Alkaligrass	*Puccinellia distans*	'Fults' or 'Salty'	0.75	1.50
Nebraska sedge	*Carex nebraskensis*		0.75	1.50
TOTAL			15.5	31.0
UPLAND SOILS				
Thickspike wheatgrass	*Elymus lanceolatus*	'Critana' or 'Bannock'	4.0	8.0
Western wheatgrass	*Pascopyrum smithii*	'Rosanna' or 'Arriba'	4.0	8.0
Indian ricegrass	*Achnatherum hymenoides*	'Nezpar' or 'Rimrock'	4.0	8.0
Sandberg bluegrass	*Poa secunda*		1.0	2.0
Bitterbrush[B]	*Purshia tridentada*		1.0	2.0
Scarlet globemallow	*Spaeralcea coccinea*		0.2	0.4
Winterfat	*Krascheninnikovia lanata*		2.0	4.0
Gardner's saltbush	*Atriplex gardneri*		1.0	2.0
Slender wheatgrass	*Elymus trachycalum*	'Revenue' or 'Prior'	2.0	
Wyoming or Basin big sagebrush[C]	*Artemisia tridentada wyomingensis* or, *A. t. tridentada*		0.2	0.4
TOTAL			17.2 - 19.4[D]	34.4 - 38.8

[A] Pure Live Seed (PLS), pounds/acre.
[B] Omit from seed mix in lower precipitation zones (<12 in.) or on sites where bitterbrush was not present prior to disturbance.
[C] If desired or required.
[D] Total pounds dependant upon saltbush, bitterbrush and sagebrush selections.

Because each plant produces vast number of seeds, some which may remain viable in the soil for ten years or longer, it is not practicable to eradicate any population that has been in existence for two years or more. However, halogeton is not competitive with vigorous perennial grasses and a major emphasis should be placed on prompt reseeding of disturbed sites, constant monitoring, and eradication of newly established spot infestations.

4.6 Final Reclamation

4.6.1 Topsoil Respreading and Seedbed Preparation

In preparation for seeding, topsoil that was initially removed should be evenly spread over the pipeline ROW, staging areas, cut-and-fill surfaces, and all areas of other sites not required for production purposes. Keep in mind that soil changes occur during storage. Chemically, the soil loses organic matter and fertility. Biologically, the number of microbes decrease with time and depth of burial. Earthworms decrease and viable seeds in the native seedbank are eliminated. Physically, soil aggregate stability is lost. If biological soil crusts were present before disturbance, the probability is high they will be negatively impacted during the topsoil removal, storage, and re-spreading process.

If construction operations allow, the Operators should consider the use of topsoil livehaul. Livehaul of salvaged soil eliminates the problems of stockpiling. Livehaul is the direct placement of freshly salvaged (not stockpiled) topsoil onto graded overburden in another area of operation. Consequently, deterioration of fertility, micro-flora, and seed viability are avoided.

Soil compaction usually results from heavy equipment working on disturbed soils prior to revegetation. Compaction can be minimized using single lift operations rather than repeatedly driving over the surface scraping off thin layers. Soil compaction can inhibit adequate revegetation of disturbance areas. Therefore, all disturbances to be revegetated should be ripped to reduce the adverse effect of compaction. All disturbed areas should be ripped on 18- to 26-inch spacing and 12 to 16 inches deep. A spring tooth harrow equipped with utility or seedbed teeth, or ripper-teeth equipment mounted behind a large crawler tractor or patrol should be used to loosen the subsoil. The subsoil surface should be left rough. After topsoil has been respread and if it is loose, it should be compacted with a cultipacker or similar implement to provide a firm seedbed. On steep slopes (greater than 40 percent and highly erosive), it may be difficult or impossible to replace topsoil and adequately prepare the seedbed. The disturbed areas on steep slopes should be ripped as described above. These areas should then be mulched with a hydromulch/seed/tackifier mix. Erosion control blankets with seed incorporated into the matting should be installed per manufacturer's specifications to enhance soil stabilization.

4.6.2 Seed Application

As stated in Section 2.4.3.7.2 of this EIS, the Operators will reseed all disturbed areas to landowner or BLM specifications. The following procedures are recommended to assure that all disturbed areas are stabilized and that revegetation efforts are enhanced so that impacts are minimized (USDI-BLM 1990a, 1997, 1999).

<u>Scarification</u>. Prior to reseeding, all compacted areas will be scarified by ripping or chiseling to loosen compacted soils. Scarification promotes water infiltration, better soil aeration and root penetration. Scarification will be done when soils are dry to promote shattering of compacted soil layers.

Seedbed Preparation. Appropriate seed bed preparation is critical for seed establishment. Seedbed preparation will be conducted immediately prior to seeding to prepare a firm seedbed conducive to proper seed placement and moisture retention. Seedbed preparation will also be performed to break up surface crusts and to eliminate weeds that may have developed between final grading and seeding. In most cases, chiseling is sufficient because it leaves a surface smooth enough to accommodate a tractor-drawn drill seeder and rough enough to catch broadcast seed and trap moisture and runoff. In low to moderate saline soils, a firm, weed-free seedbed is recommended. With high salinity levels, particularly when a high water table is involved, a fallow condition may not provide the best seedbed. If existing vegetation and weeds are chemically eradicated, the remaining dessicated roots and stems improve moisture infiltration and percolation, reduces evaporation from the soil surface, and protects emerging seedlings (Majerus 1996).

Seed Mixtures. Seed mixtures will be specified by the BLM on a site-specific basis prior to final reclamation and their selection will be justified in terms of local vegetation and soil conditions. Livestock palatability and wildlife habitat needs will be given consideration in seed mix formulation. The recommended general seed mixtures shown in Table C-2 were developed from observation of successful revegetation projects in the southwestern and south-central Wyoming regions and observation of dominant species in the project area. Recommended seeding rates are based on pounds pure live seed per acre (PLS/ac). PLS is calculated by multiplying the percent germination x percent purity of the seed lot divided by 100. All percentages are expressed as whole numbers (e.g. Wyoming big sagebrush – 12% purity x 75% germination = 12 x 75/100 = 9% PLS). Therefore, if the seed mix specifies a drill rate of 0.25 PLS/ac, the bulk seed required would be 0.25/0.09 = 2.8 lb bulk seed/ac. This amount would be doubled (5.6 lb bulk seed) for broadcast application.

These mixtures comply with Executive Order (EO) No. 11987 (Exotic Organisms). EO 11987 also specifies that use of any introduced plant species must have prior BLM approval for federal lands. BLM guidance for native seed use is BLM Manual 1745 (Introduction, Transplant, Augmentation, and Reestablishment of Fish, Wildlife, and Plants). The WGFD recommends that BLM consider shrub species in seed mixtures. On appropriate sites, BLM will coordinate with WGFD to insure that the correct shrub species are incorporated into seed mixtures on public lands.

Alternate Seed Mixes. Variations of the seed mixtures identified in Table C-2 may occur on a site-specific basis and will be specified by the BLM prior to final reclamation. An example for the ARPA would be the addition of green needlegrass (*Stipa viridula* var. *Lodorm*) on clayey sites associated with the southern portion of the project area (e.g., Muddy Mountain area).

Temporary Seed Mixes. Depending on BLM authorization, the following seed mixtures should be considered for erosion and weed control on sites that may be disturbed prior to final reclamation. The seed mixtures contain aggressive, non-native grasses that are not suitable for establishing a permanent and a diverse vegetative community but offer a temporary and competitive option to prevent halogeton invasion and establishment. The following temporary mixtures are suggested based on precipitation zone:

Semi-arid upland sites in the < 14 inches precipitation zone:

Bluebunch wheatgrass
Intermediate wheatgrass
Pubescent wheatgrass

Thickspike wheatgrass

Upland sites in the 14-22 inch precipitation zone:

Smooth brome
Paiute orchardgrass
Intermediate wheatgrass
Pubescent wheatgrass
Western wheatgrass
Thickspike wheatgrass
Alfalfa (dryland varieties)

Seed should be broadcast at the rate of 50 to 100 seeds per square foot, or 15 to 25 PLS pounds per acre. Another viable option is the use of a sterile triticale hybrid such as 'Quickguard®' (Granite Seed) to stabilize the disturbed area. The use of a non-sterile plant species such as wheat as a cover crop is not recommended because of its ability to reseed itself.

The seeded cover crop/stubble mulch is often an acceptable alternative to crimped (hay or straw) mulch. In fact, research (Schuman et al. 1980) has shown that cover crop/stubble mulch have several advantages over the use of crimped hay or straw mulch including: (1) decreased operation and application costs, (2) better wind and water erosion control, (3) increased water infiltration, (4) increased weed control, and (5) less temperature fluctuation at shallow soil depths.

Shrub Selection. For narrow and linear disturbance areas such as pipeline rights-of-way, the inclusion of native shrub seed is usually omitted from the seed mix given that a neighboring seed source is nearby and that natural shrub re-invasion and establishment will eventually return shrub density to pre-disturbance conditions. On larger disturbances the addition of a native shrub seed mix to the final seed mixture may be required to return shrub density to a pre-disturbance condition because of wildlife concerns. Commercial seed sources for most of the native shrubs found on the ARPA (e.g., Gardner's saltbush, greasewood, shadscale, winterfat, antelope bitterbrush, chokecherry, snowberry, etc.) are commercially available as well as seed for most of the big sagebrush sub-species complex (Basin, Wyoming, Vaseyana ssp.).

When specified in the final seed mixture, it is recommended that sagebrush sites be re-seeded with an identical species/sub-species identified during the pre-disturbance baseline plant inventory. Whenever possible, select seed of northern, locally adapted ecotypes. Map C-1 (from HWA 2004; will be completed when BLM's data is received) delineates the distribution of the major sagebrush taxa found on the ARPA and may serve as a general guide in the construction planning process. It is anticipated that the majority of natural gas construction and development activities on the ARPA will occur within the lower elevation Wyoming big sagebrush cover type, however, several secondary sagebrush cover types may be intermixed within this major zone. An example is the northwestern portion of the project area where smaller sub-communities of intermediate forms of basin big sagebrush are intermixed within the Wyoming big sagebrush primary cover type and occupy the many draws and swales where deeper soils and moisture availability exist. The various *Artemisia* taxa have very specific requirements for establishment and growth (e.g., sandy soils near the Sand Hills area support Plains silver sagebrush whereas clayey soils in the southern portion of the ARPA support early (= alkali) sagebrush). The baseline plant inventory should identify and describe *Artemisia* taxa on proposed disturbed sites to a sub-specific level.

Timing of Seeding. Fall seeding will occur from about September 15 until ground freeze or snow pack prevents critical seed soil coverage. The optimum time to seed a forage or cover crop in saline-alkaline soils is late fall (mid-October to December) or during a snow-free period during the winter (Majerus 1996). Ideally, in saline-alkaline soils, the seed should be in the ground before the spring season so that it can take advantage of the diluting effects of early spring moisture. Spring seeding will be completed by 15 April or as directed by the BLM. An extension to 15 May usually entails minimal risk of failure in most years. Seed will be used within 12 months of testing. The actual choice of seeding time should be based on regional climatic conditions, site-specific environmental conditions, and operator preference and experience.

Seeding Method. Drill seeding will be used where the terrain is accessible by equipment. The planting depth for most forage species is 1/4 to 1/2 inch (5-10 mm). A double disk drill equipped with depth bands, a seed agitator, and packer wheels ensures optimum seed placement. The seed should be separated by boxes to prevent seed from separating due to size and weight. Rice hulls or other appropriate material will be added to the seed as necessary to prevent separation. The drill will be properly calibrated so that seed is distributed according to the rates specified for each seed mix. If a sagebrush/grass mix is used, it is recommended to partition the seed boxes and drill to allow the slower developing shrub seeds to be planted in separate rows from the more rapidly developing grass and forb seeds. In areas where the goal is to simulate a natural appearance, the site should be drilled in multiple, cross, over-lapping patterns. This will eliminate the row crop appearance of the site.

Broadcast seeding may be used on areas too steep for drill seeding or where approved by the BLM. Broadcasted seed should occur onto a rough seedbed and then should be lightly harrowed, chained or raked to cover the seed. The seeding rate should be doubled for the recommended mixtures because the mixtures were developed for drill seeding. The method used to cover the seed should be selected so that the seed is lightly covered but maintains the surface in rough condition. The broadcast seeder should be properly calibrated or the seeding should occur over a calculated known area so that the proper seeding rate is applied.

The Operators are strongly encouraged to consider staggered seeding methods to facilitate the establishment of shrubs and/or to revegetate areas with poor quality substrates (e.g. see Coenenberg 1982, De Puit 1982). Small seeded species (e.g. big sagebrush) establish best when the seed is broadcast and lightly covered.

Any soil disturbance that occurs outside the recommended permanent seeding season, or any bare soil left unstabilized by revegetation, should be treated as a winter-construction problem and mulching should be considered, or the site stabilized. Watershed protection must be emphasized when reclaiming disturbed areas. The composition of rare and native species, if encountered, should be taken into consideration at the time of seeding; however, appropriate measures must be taken to ensure that an adequate protection of the soil surface is maintained. Areas not exhibiting successful revegetation throughout the entire area disturbed by the project should be re-seeded until an adequate cover of vegetation is established. Private and agricultural lands should be seeded with similar seed mixes unless the landowner requests different mixes.

4.6.3 Mulching

In sensitive sites where significant erosion (e.g., large areas of disturbance or areas with high erosion rates) is most likely to occur, the seeded access road/pipeline ROW, staging areas, and

the portion of the drill pads not needed for production purposes should be mulched following seeding to protect the soil from wind and water erosion, noxious/invasive weed invasion, and to hold the seed in place. The exposed surface of disturbed areas, including topsoil stockpiles, may be protected by placing crimped straw mulch, hydromulch, biodegradable plastic netting and matting, or biodegradable erosion control blankets.

All sensitive disturbed areas should be mulched immediately following seeding with 1.5 to 2.0 tons/acre of a weed-free straw mulch. Mulching materials should be free of noxious/invasive weed species as defined by state and/or county lists. Hay mulch may be used, but it should be applied only if cost-competitive and if crimped into the soil. Straw mulch is more desirable than hay mulch because it is generally less palatable to wild horses, wildlife, and livestock. Additionally, there tends to be a higher risk of introducing undesirable species with a hay mulch such as smooth brome, timothy, orchardgrass and other minor species. The lessee should maintain all disturbances relatively weed-free for the life of the project through implementation of a noxious/invasive plant species management program.

Wherever utilized, mulch should be spread uniformly so that at least 75 percent of the soil surface is covered. If a mulch blower is used, the straw strands should not be shredded less than eight inches in length to allow effective anchoring. On slopes less than 30 percent, straw mulch should be applied by a mechanical mulch blower at a rate of 2.0 tons/acre after seeding. The mulch should be crimped into the soil surface using a serrated disc crimper. Where broadcast straw mulch is applied on windswept slopes, a biodegradable plastic netting should be staked firmly to the soil surface over the mulch following the manufacturer's specifications. On slopes in excess of 40 percent or on slopes exceeding the operating capabilities of machinery, hydromulch or biodegradable erosion control blankets with seed incorporated into the netting should be applied and staked firmly to the soil surface.

Where utilized, hydromulch and tackifier should be applied at a rate of 1,500 lbs/acre. In general, erosion control and soil stabilization are directly related to the amount of mulch applied. Under certain conditions where degradation processes are slow (e.g., in extremely hot or cold dry climates), a trade-off between the degree of effectiveness of mulch and long-term degradation should be considered. In extremely dry areas where mulch degradation may be slow, mulching rates should be reduced to 1.0 to 1.5 tons/acre. Special measures may need to be implemented in areas with sandy soils.

On steeper slopes with highly erodible, shallow, rocky soils and/or on windswept areas with loose, unconsolidated materials, the above recommended measures may not be sufficient to reduce erosion to non-significant levels. The following measure should be considered by the operator and the BLM to stabilize such sites: incorporating a custom blend of seed into erosion control blankets. This method has proven cost-effective in many cases, with 98 percent of the cost being the blanket itself. The additional cost of incorporating seed into the blanket will average $1.00 to $1.50 per blanket, depending upon current seed costs. In most cases, this additional cost should offset the repeated efforts of broadcast seeding, manual raking of seeds into the soil, and mobilizing a labor force. The final measure(s) to be implemented in such areas should be determined by agreement between the BLM and Operators.

4.6.4 Grazing Management

New seedlings must be protected from grazing until they are well established. Generally, grazing should be deferred at least until the first seed crop has matured. On public lands, the deferment period will be established by the BLM. Livestock grazing should be monitored on and

along all drill sites, access road and pipeline ROWs. Should grazing negatively impact revegetation success, measures should be taken to exclude livestock from the newly reclaimed areas. Depending upon site-specific evaluations, it may be necessary to temporarily fence off certain riparian areas and wetlands to prevent excessive livestock grazing and trampling to enhance drainage channel bank stabilization and overall revegetation success. Existing livestock control structures such as fences and cattle guards should be maintained in functional condition during all phases of the project. Where access requires the disruption of an existing fence, a cattle guard should be installed at the junction.

4.6.5 Off-Road Vehicle Management

Off-road vehicle control measures should be installed and maintained following the completion of seeding. Examples of practicable measures include a locking, heavy steel gate with fencing extending a reasonable distance to prevent bypassing the gate, with appropriate signs posted; a slash and timber barrier; a pipe barrier; a line of boulders; or signs posted at all points of access at intervals not to exceed 2,000 feet indicating "RECLAMATION AREA, NO MOTORIZED VEHICLES ALLOWED BEYOND THIS POINT."

4.6.6 Dust Abatement Management

Should fugitive dust created during construction of drill sites, access road/pipeline ROWs, or staging areas become a problem, dust abatement measures should be implemented. Dust abatement using produced water will comply with all applicable WOGCC, WDEQ, or BLM requirements. Only water suitable for livestock use should be used for dust abatement and only disturbed areas should be sprayed. Spraying should be conducted in a manner that will reduce runoff and channeled flow.

4.7 Monitoring and Maintenance

4.7.1 General

A designated official or responsible party should annually inspect and review the condition of all drill sites, access road/pipeline ROWs, and any other disturbed areas associated with the project. This official should assess the success and effectiveness of all runoff and erosion control and revegetation efforts, evaluate fugitive dust control needs, and recommend remediation measures, if necessary. In addition, monitoring should take place following each major runoff event. Photographs should be taken at drill sites and along access roads at specific areas each year to document the progress of the reclamation program at established photomonitoring points.

The following specific items should be evaluated during the monitoring process:

- revegetation progress;
- evidence of sheet and rill erosion, gullies, slumping, and subsidence;
- soundness and effectiveness of erosion control measures;
- sediment filtering devices along all active ephemeral and intermittent drainage channels;
- water quality and quantity;

- noxious/invasive weed species invasion and establishment;
- degree of rodent damage on seed and seedlings;
- locations of unauthorized off-highway vehicle (OHV) access;
- soundness and effectiveness of OHV control structures;
- degree of livestock grazing and wildlife browsing; and
- overgrazing/trampling of riparian and wetland areas.

4.7.2 Reclamation Success Monitoring

Reclamation success should be based upon the objectives specified in this plan; therefore, monitoring should be tied to these objectives. The actual monitoring procedures for quantitative and qualitative evaluations of reclamation success should be implemented as specified by the BLM or other authorizing agencies.

Reclamation success should be monitored both in the short term (temporary reclamation) and in the long term (final reclamation). Monitoring of temporary reclamation measures should include visual observations of soil stability, condition, and effectiveness of mulching and runoff and erosion control measures and a quantitative and qualitative evaluation of revegetation success, where appropriate. Long-term reclamation monitoring should include visual observations of soil stability, condition of the effectiveness of mulching and runoff and erosion control measures, and a quantitative and qualitative evaluation of revegetation success.

Revegetation success will be determined by the BLM. In general, reclamation success should include the following qualitative and quantitative vegetation parameters:

1. % vegetation cover (absolute value).
2. % total ground cover (absolute value).
3. Density of shrub and sub-shrub species.
4. Areal extent of shrub mosaics.
5. Number of trees (If present).
6. Species diversity and species composition.
7. Attainment of these parameters during the last two consecutive years of the five-year period.

Below normal annual precipitation for an extended time during the five-year period may prevent these goals from being realized and should be documented and accounted for.

The pre-disturbance values of these parameters, estimated from the vegetation types actually affected by energy-related disturbances and/or from other undisturbed portions of the same type which are representative of the affected vegetation types, are used to generate the post-disturbance, long-term revegetation success goals. The baseline vegetation inventory should generate a single quantitative or qualitative value for parameters 1, 2, 3, 5 and 6 from each vegetation type and its representative reference transect. Each quantitative and qualitative goal should be clearly presented in the final reclamation plan agreed to by the Operators and the BLM.

Soil stability should be measured using an erosion condition class/soil surface factor rating method to numerically rate soil movement, surface litter, surface rock, pedestalling, flow patterns, and rill-gully formation. Information obtained through this rating system represents an expression of current erosion activity and can be used to reflect revegetation success as a function of soil stability. Grazing impacts should be assessed as an ocular estimate of the percent utilization along the transect.

The access road boundaries, pipelines, and unused portions of the drill sites should be monitored until attainment of 80 percent of predisturbance vegetative cover within five years of seeding. This standard should include 90 percent of the vegetative cover being comprised of desirable species and the erosion condition of the reclaimed area being equal to or in better condition than predisturbance conditions as prescribed under the Performance Standard section of this plan.

4.7.3 Wetland and Drainage Channel Crossings

Wetland areas and natural drainage channel crossings should be monitored for a minimum of three years for the presence of noxious or other undesirable invasive weeds. Noxious/invasive species should not be allowed to establish at any time. If found in a reclaimed wetland or drainage channel crossing, the noxious/invasive species should be removed. Undesirable species should not be allowed to establish. At the third year of monitoring, presence of undesirable species should be negligible. The lessee should maintain wetland areas and drainage channel crossings according to this standard throughout the development of a noxious/invasive weed species management program recommended by the BLM and/or the Carbon County Weed and Pest Control District Supervisor. Herbicide(s) used in wetland/riparian areas must be labeled for aquatic use and applied in accordance with label requirements. .

4.7.4 Photomonitoring

Permanent photo-monitoring points should be established at appropriate vantage locations that provide adequate visual access to drill sites, along pipeline and access road rights-of-way, and to ancillary facilities. Photos should be taken at each photo-monitoring point prior to initiation of construction through coordination with the Operator and BLM. Each photo-monitoring point should be permanently marked with a six-foot steel post driven in the ground to the top of the anchor plate. The use of rebar is not recommended because of safety concerns (e.g., future mowing projects and possible damage to equipment/truck tires). It is recommended that the top of the steel post serve as the photopoint to ensure photograph accuracy and repeatability. Each photo-point location should be recorded using Global Positioning System (GPS) technology. It is recommended the location be recorded as Universal Transverse Mecator (UTM) coordinates utilizing the CONUS NAD27 map datum. The UTM coordinates of each photo-point should be displayed and specifically identified on a GIS-generated topographic map of the area and made available to the Operators and BLM on a regular basis to reflect changes as the project develops.

Photos should be taken with a high-resolution digital camera to increase efficiency of processing and image storage. All photos should be archived in electronic format on CD-ROM. If a conventional 35 mm format camera is used, the film should be processed by the developing firm and the images saved to a CD-ROM. Each photo should be labeled with the photo-point GPS location, time, and date. This is easily done using the "text" function common to all photo-processing software programs or accomplished in the field by incorporating the necessary information written on a dry-erase board with the photograph. Hardcopy images of the

photographs should be printed in a 10 x 7 inch landscape format and used in the field to frame and duplicate succeeding photos. Photos should be taken annually until reclamation standards have been met. To minimize interpretation errors, photos should be taken approximately the same week each year if possible. During the summer months, vegetation detail (e.g., color and hue) is greatly enhanced if the photo is taken before 1000 hours or after 1500 hours. A polarizing filter is recommended for afternoon, bright sun conditions.

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APPENDIX C

HAZARDOUS MATERIALS MANAGEMENT PLAN

INTRODUCTION

This Hazardous Materials Management Plan is provided pursuant to Bureau of Land Management (BLM) Instruction Memoranda Numbers WO-93-344 and WY-94-059, which require that all National Environmental Policy Act (NEPA) documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported or disposed of as a result of a proposed project. Hazardous materials, as defined herein, are those substances listed in the Environmental Protection Agency's (EPA's) *List of Hazardous Substances* (40 Code of Federal Regulations [CFR] Part 302) and extremely hazardous materials are those identified in the EPA's *List of Extremely Hazardous Substances* (40 CFR Part 355). For purposes of this discussion, compounds included in the Clean Air Act Section 112(r) List of Substances for Accidental Release Prevention (40 CFR Part 68) are also considered hazardous materials. Materials identified on any of these lists that are expected to be used or produced by the proposed project are discussed herein.

A list of hazardous and extremely hazardous materials that are expected to be produced, used, stored, transported or disposed of as a result of exploration and production operations was assembled. Where possible, the quantities of these products or materials have been estimated on a per-well basis.

Some potentially hazardous materials that may be used in small, unquantifiable amounts have been excluded from this Management Plan. These materials may include:

- wastes, as defined by the Solid Waste Disposal Act;
- wood products, manufactured items and articles which do not release or otherwise result in exposure to a hazardous material under normal conditions of use (i.e., steel structures, automobiles, tires, etc.); and
- food, drugs, tobacco products and other miscellaneous substances (i.e., WD-40, gasket sealants, glues, etc.).

Project personnel will be directed to properly manage and dispose of hazardous materials. Solid wastes generated at well locations will be collected in approved waste facilities (e.g., dumpsters). Each well location will be provided with one or more such facilities during drilling and completion operations. Solid wastes will be regularly removed from well locations and transported to an approved disposal facility.

HAZARDOUS MATERIALS

Materials produced, used, stored, transported or disposed of during the exploration and production phases of the project may be hazardous or may contain hazardous constituents. The following discussion will address the hazardous substances generally associated with the lifecycle of a coalbed methane well.

PRODUCTION STREAMS

The purpose of the proposed project is to extract natural gas primarily from the Mesaverde Coal formation, with other deep formations targeted as well. Water, and perhaps, liquid hydrocarbons will be produced as a result of the extraction operations. Table C-1 lists and

quantifies, where possible, the hazardous and extremely hazardous substances that may be found in the production streams.

Natural Gas

Natural gas will be produced from approximately 1800 coalbed methane and, perhaps, conventional wells within the boundaries of the project at an average rate of 0.2 million cubic feet per day (mmcfd) per well. The natural gas produced from the wells will primarily contain methane, ethane, nitrogen and carbon dioxide. Hexane, polynuclear aromatic hydrocarbons (PAHs) and polycyclic organic matter (POM) are hazardous substances that may potentially be present in the gas stream. No other hazardous substances are known to occur within the natural gas stream.

The natural gas produced from the project area wells will be transported from each location through newly constructed pipelines linking well locations to existing or newly constructed centralized production facilities. Natural gas storage facilities are not expected to be utilized.

Produced Water

Produced water from wells within the project boundaries is expected to average 200 barrels per day (bpd) per well. Produced water quality from the wells within the project area is variable and will be monitored periodically. Water from the Mesaverde Coal and other targeted formations is known to contain the following hazardous substances:

Antimony	Copper	Selenium
Arsenic	Cyanide	Silver
Barium	Lead	Sodium
Beryllium	Mercury	Thallium
Cadmium	Nickel	Zinc
Chromium	Radium 226	

Phenol, an extremely hazardous substance, is also found in the produced water stream. No other hazardous or extremely hazardous materials are known to be present.

Produced water will be stored in tanks at centralized production facilities and disposed through Wyoming Department of Environmental Quality (WDEQ) or Wyoming Oil and Gas Conservation Commission (WOGCC) permitted water disposal systems. Produced water quality from wells will be monitored periodically and produced water that meets applicable standards may be discharged to the surface at appropriate locations. Agency authorizations that must be obtained prior to the disposal of produced water include:

- BLM approval of disposal methodologies;
- WDEQ Water Quality Division approval of wastewater disposal (e.g., National Pollution Discharge Elimination System permits and Underground Injection Control permits);
- WOGCC evaporation pond permits; and
- Wyoming State Engineer's Office (WSEO) dewatering permits.

Liquid Hydrocarbons

Condensate or other liquid hydrocarbon production associated with the natural gas stream is not expected from productive coalbed methane wells in the project area. However, should

any liquid hydrocarbon be produced, the stream would typically contain the following hazardous substances:

Benzene	POM
Ethylbenzene	Toluene
n-Hexane	Xylenes
PAHs	

No extremely hazardous materials are expected to be present in the liquid hydrocarbon stream.

Liquid hydrocarbons, if produced, will be stored in tanks at centralized production facilities. The tanks will be fenced and bermed to contain the entire storage capacity of the largest tank plus one foot of freeboard as mandated by the BLM. Liquid hydrocarbons, if produced, will be periodically removed from the storage tanks and transported via truck, in adherence to DOT rules and regulations, outside the project area. Necessary Regulatory approvals for the production, storage and transport of liquid hydrocarbons, including the Oil Pollution Act of 1990 (storage of >1,000,000 gal), will be addressed prior to the initiation of liquid hydrocarbon production activities.

EXPLORATION AND PRODUCTION ACTIVITIES

Exploration and production activities associated with the project area will include geophysical, construction, drilling, testing, completion, production, maintenance, transportation, abandonment, and reclamation components.

Known hazardous and extremely hazardous materials typically utilized during exploration and production operations in the project area are listed in Table C-1 and generally fall into the following categories:

- fuels;
- lubricants;
- coolant/antifreeze and heat transfer agents;
- drilling fluids;
- fracturing fluids;
- cement and additives; and
- miscellaneous materials.

Fuels

Gasoline, diesel, Jet A fuel, natural gas and propane are the fuels that may be employed within the boundaries of the project area. Each of the fuels contains materials classified as hazardous. Gasoline and diesel will be used by vehicles providing transport to and from the project area. Diesel, gasoline, and Jet A fuel will be used for geophysical survey operations. Diesel fuel will also be used in drilling operations and construction equipment, and as a minor component of fracturing fluids. Natural gas produced by the proposed project will be used to power compressor engines and other ancillary facilities. Propane will be utilized for miscellaneous heating purposes.

Gasoline

Gasoline will be used to power vehicles traveling to and from the project area. Gasoline will be purchased from regional vendors and primarily stored and transported in vehicle gas tanks. Some additional gasoline storage may be provided in appropriately designed and labeled one to five gallon containers for supplemental use as vehicle fuel. No large-scale storage of gasoline is anticipated. The hazardous substances expected to be present in gasoline include:

Benzene	n-Hexane	POM
Cumene	Methyl tert-butyl ether	Toluene
Cyclohexane	Naphthalene	Xylenes
Ethylbenzene	PAHs	

No extremely hazardous materials are expected to be present in the gasoline.

Diesel

Diesel fuel will be used to power transport vehicles, geophysical vehicles, drilling rigs and construction equipment. Each well location will have aboveground storage tanks containing diesel fuel during drilling operations. Tanks will be filled by a local fuel supplier. The use, transport and storage of diesel fuel will be conducted in accordance with all relevant local, state and federal rules, regulations and guidelines. The hazardous substances expected to be present in diesel fuel include:

Benzene	POM
Ethylbenzene	Toluene
Naphthalene	Xylenes
PAHs	

No extremely hazardous materials are expected to be present in the diesel fuel.

Jet A Fuel

Jet A fuel will be utilized to power geophysical vehicles. Jet A fuel will be purchased from regional vendors and primarily will be stored and transported in vehicle tanks. Some additional storage may be provided in appropriately designed and labeled containers for supplemental use as fuel. No large-scale storage of Jet A fuel is anticipated. The hazardous substances expected to be present in Jet A fuel include:

Benzene	n-Hexane	POM
Cumene	Methyl tert-butyl ether	Toluene
Cyclohexane	Naphthalene	Xylenes
Ethylbenzene	PAHs	

No extremely hazardous materials are expected to be present in the Jet A fuel.

Natural Gas

Natural gas produced onsite will be burned to provide power for compressor engines and other ancillary facilities. Hazardous materials expected to be present in natural gas include n-

Hexane, PAHs and POM. No extremely hazardous materials are known to exist in the natural gas from the project area.

Propane

Propane will be utilized for miscellaneous heating purposes throughout the project area. The propane will be purchased from regional vendors and transported and stored in appropriate tanks. No large scale storage of propane is anticipated. The only hazardous material expected to be present in propane is propylene. No extremely hazardous materials are known to be present in propane.

Lubricants

Various lubricants, including motor oils, hydraulic oils, transmission oils, compressor lube oils and greases, will be utilized in project equipment and machinery. Lubricants may contain hazardous substances, particularly:

Barium	Lead	PAHs
Cadmium	Manganese	POM
Copper	Nickel	Zinc

No extremely hazardous materials are known to be present in the lubricants required for the proposed project.

The lubricants will be used, stored, transported and disposed of following manufacturer's guidelines and local, state and federal requirements.

Coolant/Antifreeze and Heat Transfer Agents

Various materials will be utilized as coolant/antifreeze and heat transfer agents in association with the project. Ethylene glycol, a hazardous substance, will be used as an engine coolant/antifreeze in vehicles, construction equipment, gas dehydrators and drilling and workover rigs. Additionally, ethylene glycol will be used as a heat transfer fluid during well completion and maintenance operations. No extremely hazardous materials are known to be present in the coolant/antifreeze and heat transfer agents required for the proposed project. Disposal of ethylene glycol will be conducted in accordance with applicable local, state and federal rules and regulations.

Drilling Fluids

Water-based muds (drilling fluids) will be used for drilling each well. Drilling fluid additives consist of clays and other materials that are used in accordance with standard industry practices. Drilling fluid additives that are expected to be utilized in the drilling phase of coalbed methane well installation and their hazardous and extremely hazardous components are provided in Table C-1. Drilling operations will be conducted in compliance with applicable BLM, WOGCC and WDEQ rules and regulations.

Drilling fluid additives will be transported to well locations during drilling operations in appropriate sacks and other containers, in compliance with DOT regulations. Drilling fluids, cuttings and water will be stored in reserve pits. Netting (1 inch mesh) - to protect waterfowl, other birds and bats; pit liners - to protect shallow groundwater aquifers and conserve water;

and perimeter fencing – to protect wildlife will be used as deemed appropriate by the BLM and WOGCC.

Following drilling and completion operations, the reserve pit contents will be evaporated or solidified in place, the pit backfilled and the surface reclaimed. Reserve pit solidification and/or closure procedures will be approved by the BLM, WOGCC and/or WDEQ prior to implementation. Alternatively, reserve pit contents may be removed and disposed of at an appropriate offsite facility in a manner commensurate with applicable local, state and federal regulations.

Fracturing Fluids

Hydraulic fracturing is not expected to be performed on the coalbed methane wells within the project area. However, it is possible that a well will be hydraulically fractured periodically to augment gas flow rates. Fracturing fluids potentially containing hazardous substances that may be used within the project area are listed in Table C-1. No extremely hazardous materials are known to be present in the fracturing fluids required for the proposed project.

Fracturing fluids and additives will be transported to well locations in bulk or in appropriately designed and labeled containers. Transportation of fracturing fluids and additives will be in adherence with DOT rules and regulations.

During fracturing, fluids are pumped under pressure down the well bore and out through perforations in the casing into the formation. The pressurized fluid enters the formation and induces hydraulic fractures. When the pressure is released at the surface, a portion of the fracturing fluids will be forced back into the well bore, up to the surface and into a tank. The fracturing fluids will then be transferred to lined reserve pits and evaporated or transported offsite for reuse or disposal at an authorized facility. Decisions regarding the appropriate disposal of fracturing fluids would be made by the BLM, WOGCC and DEQ on a case-by-case basis.

Cement and Additives

Well completion and abandonment operations include cementing and plugging various segments of the well bore to protect freshwater aquifers and other downhole resources. Materials potentially used for cementing operations include: cement, calcium hydroxide, calcium chloride, pozzolans, sodium bicarbonate, potassium chloride and insulating oil. An unknown quantity of cement and additives, which may contain the hazardous material classes of fine mineral fibers, PAHs and POM, will be transported in bulk to each well site. Small quantities may also be transported and stored onsite in 50 pound sacks. Wells will be cased and cemented as directed and approved by the BLM or WOGCC.

Miscellaneous Materials

Miscellaneous materials will be used during geophysical, construction, drilling, testing, completion, production, maintenance, transportation, abandonment, and reclamation activities. Miscellaneous materials potentially containing hazardous substances that may be used within the project area are listed in Table C-1. Quantities of these miscellaneous materials are unknown. Materials will be transported to the site by service and supply companies and will be used, stored, transported and disposed of following manufacturer's guidelines and local, state and federal requirements.

Industry standard pipeline materials, equipment, techniques and procedures, in conformance with all applicable regulatory requirements, will be employed during construction, testing, operation and maintenance activities to ensure pipeline safety and efficiency.

Small quantities of natural gas may be vented at certain well locations during testing operations. During testing, produced gas will be vented into a flare pit pursuant to the applicable BLM, WOGCC and WDEQ rules and regulations. BLM, WOGCC and WDEQ approval, as appropriate, will be obtained prior to venting operations.

COMBUSTION EMISSIONS

Gasoline and diesel engines, flaring of natural gas and fired production equipment will produce combustion emissions within the project area. The complete oxidation of hydrocarbon fuels yields only carbon dioxide and water as combustion products. However, complete combustion is seldom achieved. Unburned hydrocarbons, particulate matter, carbon monoxide, nitrogen oxides, and possibly, sulfur oxides will be components of the exhaust streams. The formation of ozone from the photolysis of nitrogen oxides will also be expected. A listing of the hazardous and extremely hazardous materials potentially present in combustion emissions is provided in Table C-1.

Unburned hydrocarbons may contain potentially hazardous PAHs, while particulate matter may contain metal based particles from metallic lubricating oil additives and engine wear. Hazardous materials in the particulate matter may therefore include compounds of lead, cadmium, nickel, copper, manganese, barium and/or zinc. Particulate matter emissions and larger unburned hydrocarbons will eventually settle out on the ground surface, whereas gaseous emissions will react with other air constituents as components of the nitrogen, sulfur and carbon cycles.

Nitrogen dioxide, sulfur dioxide, sulfur trioxide and ozone are potential combustion emissions, all classified as extremely hazardous materials. Releases of these or other materials will not exceed allowable thresholds established by the Prevention of Significant Deterioration and WDEQ Air Quality regulations or the National Ambient Air Quality Standards.

MANAGEMENT POLICY AND PROCEDURE

Project operators and their contractors will ensure production, use, storage, transport and disposal of hazardous and extremely hazardous materials associated with the proposed project will be accomplished in strict accordance with applicable existing, or hereafter promulgated, federal, state and local government rules, regulations and guidelines. Project related activities, involving the production, use and/or disposal of hazardous or extremely hazardous materials, will be conducted in such a manner so as to minimize potential environmental impacts.

Project operators will comply with emergency reporting requirements for releases of hazardous materials. Releases of hazardous or extremely hazardous substances in excess of the reportable quantity, as established in 40 CFR Part 117, will be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. The materials for which such notification must be given are the extremely hazardous substances listed under the Emergency Planning and Community Right to Know Act, Section 302 and the hazardous substances designated under Section 102 of CERCLA, as amended. If a reportable quantity of a hazardous or extremely hazardous substance is

released, prompt notice of the release will be given to the BLM's Authorized Officer and other appropriate local, state and federal agencies.

Additionally, notice of any spill or leakage (i.e. undesirable event), as defined in BLM NTL-3A, will be provided to the Authorized Officer and other such local, state and federal officials as required by law.

Project operators will prepare and implement, as necessary, the following plans and/or policies:

- spill prevention and control countermeasure plans;
- stormwater pollution prevention plans;
- liquid hydrocarbon spill response plans;
- inventories of hazardous chemical categories pursuant to Section 312 of the SARA, as amended; and
- emergency response plans.

Copies of the above will be maintained by the operators, as required by regulation, and will be made available upon request.

Exploration and production activities in the project area will comply with regulations promulgated under the Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Clean Water Act, Safe Drinking Water Act, Toxic Substances Control Act, Occupational Safety and Health Act, Clean Air Act, National Environmental Policy Act and Endangered Species Act, as appropriate. In addition, project activities will also comply with applicable state rules and regulations relating to hazardous material handling, storage, transportation, management, disposal, and reporting.

Table C-1. Hazardous and Extremely Hazardous Materials Potentially Utilized or Produced During Construction, Drilling, Production, and Reclamation Operations

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
Production Streams				
Natural gas				0.2 mmcfd
	n-Hexane		110-54-3	
	PAHs[4]		-	
	POM[5]		-	
Produced Water				200 bpd
	Antimony		7440-36-0	
	Arsenic		7440-38-2	
	Barium		7440-39-3	
	Beryllium		7440-41-7	
	Cadmium		7440-43-9	
	Chromium		7440-47-3	
	Copper		7440-50-8	
	Cyanide		-	
	Lead		7439-92-1	
	Mercury		7439-97-6	
	Nickel		7440-02-0	
		Phenols	108-95-2	
	Radium 226		-	
	Selenium		7782-49-2	
	Silver		7440-22-4	
	Sodium		7440-23-5	
	Thallium		7440-28-0	
	Zinc		7440-66-6	
Liquid Hydrocarbons				UNK
	Benzene		71-43-2	
	Ethylbenzene		100-41-4	
	n-Hexane		110-54-3	
	PAHs		-	
	POM		-	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
Fuels				
Gasoline				UNK
	Benzene		71-43-2	
	Cumene		98-82-8	
	Cyclohexane		110-82-7	
	Ethylbenzene		100-41-4	
	n-Hexane		110-54-3	
	Methyl tert-butyl ether		1634-04-4	
	Naphthalene		91-20-3	
	PAHs		-	
	POM		-	
	Toluene		108-88-3	
	Xylenes		1330-20-7	

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
Diesel				UNK
	Benzene		71-43-2	
	Cumene		98-82-8	
Diesel – cont.	Ethylbenzene		10041-4	
	Naphthalene		91-20-3	
	PAHs		-	
	POM		-	
	Toluene		108-88-3	
	Xylenes		108-38-3	
Jet A Fuel				UNK
	Benzene		71-43-2	
	Cumene		98-82-8	
	Cyclohexane		110-82-7	
	Ethylbenzene		100-41-4	
	n-Hexane		110-54-3	
	Methyl tert-butyl ether		1634-04-4	
	Naphthalene		91-20-3	
	PAHs		-	
	POM		-	
	Toluene		108-88-3	
	Xylenes		108-38-3	
Natural Gas				UNK
	n-Hexane		110-54-3	
	PAHs		-	
	POM		-	
Propane				UNK
	Propylene		115-07-1	
Lubricants				UNK
	Barium		7440-39-3	
	Cadmium		7440133-9	
	Copper		7440-50-8	
	Lead		7439-92-1	
	Manganese		7439-96-5	
	Nickel		7440-02-0	
	PAHs		-	
	POM		-	
	Zinc		7440-66-6	
Coolant/Antifreeze and Heat Transfer Agents				UNK
	Ethylene glycol		107-21-1	
Drilling Fluids				
Barite	Barium compounds		-	16,000 lb
	Fine mineral fibers		-	
Bentonite	Fine mineral fibers		-	45,000 lb

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
Caustic soda	Sodium hydroxide		1310-73-2	750 lb
Glutaraldehyde	Isopropyl alcohol		67-63-0	20 gal
Lime	Fine mineral fibers		-	3,500 lb
Mica	Fine mineral fibers		-	600 lb
Modified tannin	Ferrous sulfate		7720-78-7	250 lb
	Fine mineral fibers		-	
Phosphate esters	Methanol		67-56-1	100 gal
Polyacrylamides		Acrylamide	79-06-1	100 gal
	PAHs		-	
	POM		-	
Retarder	Fine mineral fibers		-	400 lb
Fracturing Fluids				
Biocides	Fine mineral fibers		-	UNK
	PAHs		-	
	POM		-	
Breakers	Copper compounds		-	UNK
	Ethylene glycol		107-21-1	
	Fine mineral fibers		-	
	Glycol ethers		-	
Clay stabilizer	Fine mineral fibers		-	UNK
	Glycol ethers		-	
	Isopropyl alcohol		67-63-0	
	Methanol		67-56-1	
	PAHs		-	
	POM		-	
Crosslinkers	Ammonium chloride		12125-02-9	UNK
	Methanol		67-56-1	
	Potassium hydroxide		1310-58-3	
	Zirconium nitrate		13746-89-9	
	Zirconium sulfate		14644-61-2	
Foaming agent	Glycol ethers		-	UNK
Gelling agent	Benzene		71-43-2	UNK
	Ethylbenzene		100-41-4	
	Methyl tert-butyl ether		1634-04-4	
	Napthalene		91-20-3	
	PAHs		-	
	POM		-	
	Sodium hydroxide		1310-73-2	
	Toluene		108-88-3	
	Xylenes		1330-20-7	

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
pH buffers	Acetic acid		64-19-7	UNK
	Benzoic acid		65-85-0	
	Fumaric acid		110-17-8	
	Hydrochloric acid		7647-01-0	
	Sodium hydroxide		1310-73-2	
Sands	Fine mineral fibers		-	UNK
Solvents	Glycol ethers		-	UNK
Surfactants	Glycol ethers		-	UNK
	Isopropyl alcohol		67-63-0	
	Methanol		67-56-1	
	PAHs		-	
	POM		-	
Cement and Additives				
Anti-foamer	Glycol ethers		-	100 lb
Calcium chloride flake	Fine mineral fibers		-	2,500 lb
Cellophane flake	Fine mineral fibers		-	300 lb
Cements	Aluminum oxide		1344-28-1	77,000 lb
	Fine mineral fibers		-	
Chemical wash	Ammonium hydroxide		1336-21-6	850 gal
	Glycol ethers		-	
Diatomaceous earth	Fine mineral fibers		-	1,000 lb
Extenders	Aluminum oxide		1344-28-1	17,500 lb
	Fine mineral fibers		-	
Fluid loss additive		Acrylamide	79-06-1	900 lb
	Fine mineral fibers		-	
	Naphthalene		91-20-3	
Friction reducer	Fine mineral fibers		-	160 lb
	Naphthalene		91-20-3	
	PAHs		-	
	POM		-	
Mud flash	Fine mineral fibers		-	250 lb
Retarder	Fine mineral fibers		-	100 lb
Salt	Fine mineral fibers		-	2,570 lb
Silica flour	Fine mineral fibers		-	4,800 lb

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
Miscellaneous Materials				
Acids	Acetic anhydride		108-24-7	UNK
	Formic acid		64-18-6	
	Sodium chromate		777-11-3	
		Sulfuric acid	7664-93-9	
Batteries	Cadmium		744043-9	UNK
		Cadmium oxide	1306-19-0	
	Lead		7439-92-1	
	Nickel hydroxide		7440-02-0	
	Potassium hydroxide		1310-58-3	
		Sulfuric acid	7664-93-9	
Biocides		Formaldehyde	50-00-0	UNK
	Isopropyl alcohol		67-63-0	
	Methanol		67-56-1	
Cleaners	Hydrochloric acid		7647-01-0	UNK
Corrosion inhibitors	4,4' Methylene dianiline		101-77-9	UNK
	Acetic acid		64-19-7	
	Ammonium bisulfite		10192-30-0	
	Diethylamine		109-89-7	
	Dodecylbenzenesulfonic acid		27176-87-0	
	Ethylene glycol		107-21-1	
	Isobutyl alcohol		78-83-1	
	Isopropyl alcohol		67-63-0	
	Methanol		67-56-1	
	Naphthalene		91-20-3	
	Sodium nitrite		7632-00-0	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
	Zinc carbonate		3486-35-9	
Emulsion breakers	Acetic acid		64-19-7	UNK
	Acetone		67-64-1	
	Ammonium chloride		12125-02-9	
	Benzoic acid		65-85-0	
	Isopropyl alcohol		67-63-0	
	Methanol		67-56-1	
	Naphthalene		91-20-3	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
	Zinc chloride		7646-85-7	
Explosives, fuses, detonators, and boosters	Benzene		71-43-2	UNK
	Cumene		98-82-8	
	Ethylbenzene		100-41-4	
	Ethylene glycol		107-21-1	
	Lead compounds		7439-92-1	
	Methyl tert-butyl ether		1634-04-0	
	Naphthalene		91-20-3	
		Nitric acid	7697-37-2	
	Nitroglycerine		55-63-0	

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
	PAHs		-	
	POM		-	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
Fertilizers	UNK		-	UNK
Herbicides	UNK		-	UNK
Lead-free thread compound	Copper		7440-50-8	25 gal
	Zinc		7440-66-6	
Methanol	Methanol		67-56-1	200 gal
Motor oil	Zinc compounds		-	220 gal
Paints	Barium		7440-39-3	UNK
	n-Butyl alcohol		71-36-3	
	Cobalt		7440-48-4	
	Lead		7439-92-1	
	Manganese		7439-96-5	
	PAHs		-	
	POM		-	
		Sulfuric acid	7664-93-9	
	Toluene		108-88-3	
	Triethylamine		121-44-8	
	Xylenes		1330-20-7	
Paraffin control		Carbon disulfide	75-15-0	UNK
	Ethylbenzene		100-41-4	
	Methanol		67-56-1	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
Photoreceptors	Selenium		7782-49-2	UNK
Pipeline -				
Coating	Aluminum oxide		1334-28-1	UNK
Cupric sulfate solution	Cupric sulfate		7758-98-7	UNK
		Sulfuric acid	7664-93-9	
Diethanolamine	Diethanolamine		111-42-2	UNK
LP Gas	Benzene		71-43-2	UNK
	n-Hexane		110-54-3	
	Propylene		115-07-1	
Molecular sieves	Aluminum oxide		1344-28-1	UNK
Pipeline primer	Naphthalene		91-20-3	UNK
	Toluene		108-88-3	
Potassium	Potassium hydroxide		1310-58-3	UNK

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
Rubber resin coatings	Acetone		67-64-1	UNK
	Ethyl acetate		141-78-6	
	Methyl ethyl ketone		78-93-3	
	Toluene		108-88-3	
	Xylene		1330-20-7	
Scale inhibitors	Acetic acid		64-19-7	UNK
	Ethylene diamine tetraacetic acid		60-00-4	
	Ethylene glycol		107-21-1	
	Formaldehyde		50-00-0	
	Hydrochloric acid		7647-01-0	
	Isopropyl alcohol		67-63-1	
	Methanol		67-56-1	
	Nitrilotriacetic acid		139-13-9	
Sealants	1,1,1-trichloroethane		71-55-6	UNK
	n-Hexane		110-54-3	
	PAHs		-	
	POM		-	
Solvents	1,1,1-trichloroethane		71-55-6	UNK
	Acetone		67-64-1	
	t-Butyl alcohol		75-65-0	
	Carbon tetrachloride		56-23-5	
	Isopropyl alcohol		67-63-0	
	Methyl ethyl ketone		108-10-1	
	Methanol		67-56-1	
	PAHs		-	
	POM		-	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
Starting fluid	Ethyl ether		60-29-7	UNK
Surfactants		Ethylene diamine	107-15-3	UNK
	Isopropyl alcohol		67-56-1	
Combustion Emissions				
Combustion Products		Formaldehyde	50-00-0	XXXX
		Nitrogen dioxide	10102-44-0	XXXX
		Ozone	10028-15-6	XXXX
		Sulfur dioxide	7446-09-5	XXXX
		Sulfur trioxide	7446-11-9	XXXX
Unburned Hydrocarbons	Benzene		71-43-2	XXXX
	Ethylbenzene		100-41-4	
	n-Hexane		100-54-3	
	PAHs		-	
	Toluene		108-88-3	
	Xylenes		1330-20-7	
Particulate matter	Barium		7440-39-3	XXXX
	Cadmium		7440-43-9	

Table C-1. Continued.

SOURCE	HAZARDOUS SUBSTANCES[1]	EXTREMELY HAZARDOUS SUBSTANCES[2]	CAS NO.	APPROXIMATE QUANTITIES USED OR PRODUCED PER WELL[3]
	Copper		7440-50-8	
	Fine mineral fibers		-	
	Lead		7439-92-1	
	Manganese		7439-96-5	
	Nickel		7440-02-0	
	POM		-	
	Zinc		7440-66-6	

1 Hazardous Substances include those compounds identified in EPA's List of Hazardous Substances – 40 CFR Part 302 and List of Substances for Accidental Release Prevention – 40 CFR Part 68.
2 Extremely Hazardous Substances include those compounds identified in EPA's List of Extremely Hazardous Substances – 40 CFR Part 355.
3 lb = pounds, gal = gallons, mmcfd = million cubic feet per day, bpd = barrels per day and UNK = unknown
4 PAHs – Polynuclear aromatic hydrocarbons
5 POM – Polycyclic organic matter

APPENDIX D

WILDLIFE AND FISH SPECIES LISTS

Table D-1. Wildlife species observed or that may potentially occur on or near the Atlantic Rim Project Area.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
MAMMALS					
Badger	*Taxidea taxus*	y	y		y
Bighorn sheep	*Ovis canadensis*	y			
Beaver	*Castor canadensis*	y	y		
Big-brown bat	*Eptesicus fuscus*		y		
Bison	*Bison bison*	y	y		
Black bear	*Ursus americanus*	y	y		
Black-footed ferret	*Mustela nigripes*		y		
Bobcat	*Felis rufus*	y	y		y
Bushy-tailed wood rat	*Neotoma cinerea*	y	y		
Cliff chipmunk	*Tamias dorsalis*		y		
Coyote	*Canis latrans*	y	y		y
Deer mouse	*Peromyscus maniculatus*	y	y		y
Desert cottontail	*Sylvilagus audubonii*	y	y		y
Dusky shrew	*Sorex monticolus*		y		
Dwarf shrew	*Sorex nanus*		y	y	
Eastern cottontail	*Sciurus carolinensis*	y			
Eastern red bat	*Lasiurus borealis*	y	y		
Eastern fox squirrel	*Sciurus niger*		y		
Elk	*Cervus elaphus*	y	y		y
Feral horse	*Equus caballus*	y			y
Golden-mantled groundsquirrel	*Spermophilus lateralis*	y	y		
Grizzly bear	*Ursus arctos*		y		
Hoary bat	*Lasiurus cinereus*		y	y	
Least chipmunk	*Tamias minimus*	y	y		y
Little brown myotis	*Myotis lucifugus*		y		
Long-eared myotis	*Myotis evotis*		y	y	
Long-tailed vole	*Microtus longicaudus*		y		
Long-tailed weasel	*Mustela frenata*	y	y		y
Marten	*Martes americana*	y	y		
Masked shrew	*Sorex cinereus*	y	y		
Meadow vole	*Microtus pennsylvanicus*	y			
Merriam's shrew	*Sorex merriami*		y		
Mink	*Mustela vison*	y	y		
Montane vole	*Microtus montanus*	y	y		
Moose	*Alces alces shirasi*	y	y		
Mountain (Nuttall's) cottontail	*Sylvilagus nuttallii*	y	y		
Mountain lion	*Felis concolor*	y	y		
Mule deer	*Odocoileus hemionus*	y	y		y
Muskrat	*Ondatra zibethicus*	y	y		y
Northern grasshopper mouse	*Onychomys leucogaster*	y	y		
Northern pocket gopher	*Thomomys talpoides*		y		
Olive-backed pocket mouse	*Perognathus fasciatus*	y	y		

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Ord's kangaroo rat	*Dipodomys ordii*	y	y		y
Pika	*Ochotona princeps*		y		
Porcupine	*Erethizon dorsatum*	y	y		y
Pronghorn antelope	*Antilocapra americana*	y	y		y
Raccoon	*Procyon lotor*	y	y		
Red fox	*Vulpes vulpes*	y	y		
Red squirrel	*Tamiasciurus hudsonicus*	y	y		
Ringtail	*Bassariscus astutus*			y	
Sagebrush vole	*Lemmiscus curtatus*	y	y		
Short-tailed (ermine) weasel	*Mustela erminea*		y		
Silky pocket mouse	*Perognathus flavus*		y		
Silver-haired bat	*Lasionycteris noctivagans*	y	y		
Snowshoe hare	*Lepus americanus*	y	y		
Southern red-backed vole	*Clethrionomys gapperi*	y	y		
Spotted ground squirrel	*Spermophilus tridecemlineatus*		y		
Striped skunk	*Mephitis mephitis*	y	y		
Swift fox	*Vulpes velox*		y		
Thirteen-lined groundsquirrel	*Spermophilus tridecemlineatus*	y	y		
Townsend's big-eared bat	*Corynorhinus towsendii*			y	
Uinta ground squirrel	*Spermophilus armatus*		y		
Water shrew	*Sorex palustris*		y		
Western heather vole	*Phenacomys intermedius*		y		
Western jumping mouse	*Zapus princeps*	y	y		
Western small-footed myotis	*Myotis ciliolabrum*	y	y		
Western spotted skunk	*Spilogale gracilis*			y	
White-tailed deer	*Odocoileus virginianus*	y	y		
White-tailed jackrabbit	*Lepus townsendii*	y	y		y
White-tailed prairie dog	*Cynomys leucurus*	y	y	y	y
Wyoming ground squirrel	*Spermophilus elegans*	y	y		y
Wyoming pocket gopher	*Thomomys clusius*		y	y	
Yellow-bellied marmot	*Marmota flaviventris*	y	y		
BIRDS					
American avocet	*Recurvirostra americana*	y	y		y
American bittern	*Botaurus lentiginosus*	y	y		
American coot	*Fulica americana*	y	y		y
American crow	*Corvus brachyrhynchos*	y	y		y
American dipper	*Cinclus mexicanus*	y	y		
American goldfinch	*Carduelis tristis*	y	y		
American kestrel	*Falco sparverius*	y	y		y
American pipit	*Anthus rubescens*	y	y		
American redstart	*Setophaga ruticilla*	y	y		
American robin	*Turdus migratorius*	y	y		y
American tree sparrow	*Spizella arborea*	y	y		
American white pelican	*Pelecanus erythrorhynchos*	y	y		
American wigeon	*Anas Americana*	y	y		y
Ash-throated flycatcher	*Myiarchus cinerascens*		y		

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Baird's sandpiper	*Calidris bairdii*	y	y		
Baird's sparrow	*Ammodramus bairdii*	y			
Bald eagle	*Haliaeetus luecocephalus*	y	y	y	
Baltimore oriole	*Icterus galbula*	y			
Bank swallow	*Riparia riparia*	y	y		y
Barn swallow	*Hirundo rustica*	y	y		
Barrow's goldeneye	*Bucephala islandica*		y		
Belted kingfisher	*Ceryle alcyon*	y	y		
Bewick's wren	*Thryomanes bewickii*	y	y		
Black rosy-finch	*Leucosticte atrata*		y		
Black tern	*Chlidonias niger*	y	y		
Black-and-white warbler	*Mniotilta varia*		y		
Black-bellied plover	*Pluvialis dominicus*	y	y		
Black-billed cuckoo	*Coccyzus erythropthalmus*		y		
Black-billed magpie	*Pica pica*	y	y		y
Black-capped chickadee	*Parus atricapillus*	y	y		
Black-chinned hummingbird	*Archilochus alexandri*			y	
Black-crowned night heron	*Nycticorax nycticorax*	y	y		
Black-headed grosbeak	*Pheucticus melanocephalus*	y	y		
Black-necked stilt	*Himantopus mexicanus*	y	y		
Black-throated gray warbler	*Dendroica caerulescens*		y	y	
Blue grosbeak	*Guiraca caerulea*		y		
Blue grouse	*Dendragapus obscurus*	y	y		
Blue jay	*Cyanocitta cristata*		y		
Blue-gray gnatcatcher	*Polioptila caerulea*	y	y		
Blue-winged teal	*Anas discors*	y	y		y
Bobolink	*Dolichonyx oryzivorus*	y	y	y	?
Bohemian waxwing	*Bombycilla garrulus*		y		
Bonaparte's gull	*Spizella breweri*	y	y		
Brewer's sparrow	*Euphagus cyanocephalus*	y	y	y	y
Brewer's blackbird	*Selasphorus platycercus*	y	y		
Broad-tailed hummingbird	Selasphorus platycercus	y	y		
Broad-winged hawk	*Buteo platypterus*		y		
Brown creeper	*Certhia americana*	y	y		
Brown thrasher	*Taxostoma rufum*	y	y		
Brown-capped rosy-finch	*Leucosticte australis*		y		
Brown-headed cowbird	*Molothrus ater*	y	y		y
Buff-breasted sandpiper	*Tryngites subruficollis*	y	y		
Bufflehead	*Bucephala albeola*	y	y		y
Burrowing owl	*Athene cunicularia*	y	y	y	y
California gull	*Larus californicus*	y	y		
Canada goose	*Branta canadensis*	y	y		y
Canvasback	*Aythya valisineria*	y	y		
Canyon wren	*Catherpes mexicanus*	y	y		
Cassin's finch	*Carpodacus cassinii*	y	y		
Cattle egret	*Bubulcus ibis*		y		
Cedar waxwing	*Bombycilla cedrorum*		y		
Chestnust-collared longspur	*Calcarius ornatus*	y			

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Chipping sparrow	*Spizella passerina*	y	y		
Cinnamon teal	*Anas cyanoptera*	y	y		y
Clark's nutcracker	*Nucifraga columbiana*	y	y		
Cliff swallow	*Hirundo pyrrhonota*	y	y		
Common goldeneye	*Bucephala clangula*		y		
Common grackle	*Quiscalus quiscula*	y	y		
Common merganser	*Mergus merganser*	y	y		y
Common nighthawk	*Chordeiles minor*	y	y		
Common poorwill	*Phalaenoptilus nuttallii*	y	y		
Common raven	*Corvus corax*	y	y		y
Common snipe	*Gallinago gallinago*	y	y		y
Common tern	*Sterna hirundo*	y			
Common yellowthroat	*Geothylpis trichas*	y	y		
Cooper's hawk	*Accipiter cooperii*	y	y		
Cordilleran fly catcher	*Empidonax occidentalis*	y	y		
Dark-eyed junco	*Junco hyemalis*	y	y		
Double-crested cormorant	*Phalacrocorax auritus*	y	y		
Downy woodpecker	*Picoides pubescens*	y	y		
Dusky flycatcher	*Empidonax oberholseri*	y	y		
Eared grebe	*Podiceps nigricollis*	y	y		
Eastern kingbird	*Tyrannus tyrannus*	y	y		
Eastern screech owl	*Otus asio*	y			
European starling	*Sturnus vulgaris*	y	y		y
Evening grosbeak	*Coccothraustes vespertinus*	y	y		
Ferruginous hawk	*Buteo regalis*	y	y		y
Field sparrow	*Spizella pusilla*	y			
Forster's tern	*Sterna forsteri*	y	y		
Fox sparrow	*Passerella iliaca*	y	y		
Franklin's gull	*Larus pipixcan*	y	y		
Gadwall	*Anas strepera*	y	y		y
Golden eagle	*Aquila chrysaetos*	y	y		y
Golden-crowned kinglet	*Regulus satrapa*	y	y		
Grasshopper sparrow	*Ammodramus savannarum*	y			
Gray catbird	*Dumetella carolinensis*	y	y		
Gray flycatcher	*Empidonax wrightii*	y	y		
Gray jay	*Perisoreus canadensis*	y	y		
Gray-crowned rosy-finch	*Leucosticte tephrocotis*	y	y		
Great-blue heron	*Ardea herodias*	y	y		
Greater yellowlegs	*Tringa melanoleuca*	y	y		
Great horned owl	*Bubo virginianus*	y	y		y
Green heron	*Butorides virescens*	y	y		
Green-tailed towhee	*Pipilo chlorurus*	y	y		
Green-winged teal	*Anas crecca*	y	y		y
Hairy woodpecker	*Picoides villosus*	y	y		
Hammond's flycatcher	*Empidonax hammondii*		y	y	
Horned grebe	*Podiceps auritus*	y			
Hermit thrush	*Catharus guttatus*	y	y		
Herring gull	*Larus argentatus*	y			

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Horned lark	*Eremophila alpestris*	y	y		y
House finch	*Carpodacus mexicanus*	y	y		
House sparrow	*Passer domesticus*		y		
House wren	*Troglodytes aedon*	y	y		
Hudsonian godwit	*Limosa haemastica*	y			
Indigo bunting	*Passerina cyanea*		y		
Killdeer	*Charadrius vociferus*	y	y		y
Lark bunting	*Calamospiza melanocorys*	y	y		
Lark sparrow	*Chondestes grammacus*	y	y		
Lazuli bunting	*Passerina ameoena*		y		
Least flycatcher	*Empidonax minimus*		y		
Least sandpiper	*Calidris minutilla*	y	y		
Lesser scaup	*Aythya affinis*	y	y		y
Lesser yellowlegs	*Tringa flavipes*	y	y		
Lewis' woodpecker	*Melanerpes lewis*	y	y	y	
Lincoln's sparrow	*Melospiza lincolnii*		y		
Loggerhead shrike	*Lanius ludovicianus*	y	y		y
Long-billed curlew	*Numenius americanus*	y	y		
Long-billed dowitcher	*Limnodromus scolopaceus*	y	y		y
Long-eared owl	*Asio otus*	y	y		
Macgillivray's warbler	*Oporornis tolmiei*	y	y		
Mallard	*Anas platyrhynchos*	y	y		y
Marbled godwit	*Limosa fedora*	y	y		
Marsh wren	*Cistothorus palustris*	y	y		
McCown's longspur	*Calcarius mccownii*		y	y	
Merlin	*Falco columbarius*	y	y	y	y
Mountain bluebird	*Sialia currucoides*	y	y		y
Mountain chickadee	*Parus gambeli*	y	y		
Mountain plover	*Charadrius montanus*	y	y	y	y
Mourning dove	*Zenaida macroura*	y	y		y
Northern (Bullock's) oriole	*Icterus bullockii*		y		
Northern flicker	*Colaptes auratus*	y	y		y
Northern goshawk	*Accipiter gentilis*	y	y	y	
Northern harrier	*Circus cyaneus*	y	y		y
Northern mockingbird	*Mimus polyglottos*		y		
Northern pintail	*Anas acuta*	y	y		y
Northern rough-winged swallow	*Stelgidopteryx serripennis*	y	y		
Northern saw-whet owl	Aegolius acadicus		y		
Northern shoveler	*Anas clypeata*	y	y		
Northern shrike	*Lanius excubitor*	y	y		
Northern waterthrush	*Seiurus noveboracensis*		y		
Olive-sided flycatcher	*Contopus borealis*	y	y		
Orange-crowned warbler	*Vermivora celata*	y	y		
Ovenbird	*Seiurus aurocapillus*		y		
Osprey	*Pandion haliaetus*	y			
Pectoral sandpiper	*Calidris melanotos*	y	y		
Peregrine falcon	*Falco peregrinus*	y	y		

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Pied billed grebe	*Podilymbus podiceps*	y	y		
Pine grosbeak	*Pinicola enucleator*		y		
Pine siskin	*Carduelis pinus*	y	y		
Pinyon jay	*Gymnorhinus cyanocephalus*	y	y		
Plain titmouse	*Baeolophus griseus*	y		y	
Prairie falcon	*Falco mexicanus*	y	y		y
Red crossbill	*Loxia curvirostra*	y	y		
Red-breasted merganser	*Mergus serrator*		y		
Red-breasted nuthatch	*Sitta canadensis*	y	y		
Red-eyed vireo	*Vireo olivaceus*		y		
Redhead	*Aythya americana*	y	y		
Red-naped sapsucker	*Sphyrapicus nuchalis*	y	y		
Red-necked grebe	*Podiceps grisegena*	y			
Red-necked phalarope	*Phalaropus lobatus*	y	y		
Red-tailed hawk	*Buteo jamaicensis*	y	y		y
Red-winged blackbird	*Agelaius phoeniceus*	y	y		
Ring-billed gull	*Larus delawarensis*	y	y		
Ring-necked duck	*Aythya collaris*	y	y		y
Ring-necked pheasant	*Phasianus colchicus*	y			
Rock dove	*Columba livia*		y		
Rock wren	*Salpinctes obsoletus*	y	y		
Rose-breasted grosbeak	*Pheucticus ludovicianus*	y			
Rough-legged hawk	*Buteo lagopus*	y	y		
Ruby-crowned kinglet	*Regulus calendula*	y	y		
Ruddy duck	*Oxyura jamaicensis*	y	y		y
Ruddy turnstone	*Arenaria interpres*	y	y		
Rufous hummingbird	*Selasphorus rufus*		y		
Greater sage-grouse	*Centrocercus urophasianus*	y	y		y
Sage sparrow	*Amphispiza belli*	y	y	y	
Sage thrasher	*Oreoscoptes montanus*	y	y		y
Sanderling	*Calidris alba*	y	y		
Sandhill crane	*Grus canadensis*	y	y		
Savannah sparrow	*Passerculus sandwichensis*	y	y		
Say's phoebe	*Sayornis saya*	y	y		
Scott's oriole	*Icterus parisorum*		y	y	
Semipalmated plover	*Charadrius semiplamatus*	y	y		
Semipalmated sandpiper	*Calidris pusilla*	y	y		
Sharp-shinned hawk	*Accipiter striatus*	y	y		
Sharp-tailed grouse	*Tympanuchus phasianellus*	y	y	y	
Short-eared owl	*Asio flammeus*	y	y	y	
Snow bunting	*Plectrophenax nivalis*	y	y		
Snow goose	*Chen caerulescens*	y			
Snowy egret	*Egretta thula*	y	y		
Snowy plover	*Charadrius alexandrinus*	y	y	y	
Sora	*Porzana carolina*	y	y		
Solitary sandpiper	*Tringa solitaria*	y	y		
Solitary vireo	*Vireo solitarius*	y	y		

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Song sparrow	*Melospiza melodia*	y	y		
Spotted sandpiper	*Actitis macularia*	y	y		
Spotted towhee	*Pipilo maculatus*		y		
Steller's jay	*Cyanocitta stelleri*	y	y		
Stilt sandpiper	*Calidris himantopus*	y	y		
Swainson's hawk	*Buteo swainsoni*	y	y		y
Swainson's thrush	*Catharus ustulatus*		y		
Swamp sparrow	*Melospiza georgiana*		y		
Tennessee warbler	*Vermivora peregrina*		y		
Three-toed woodpecker	*Picoides tridactylus*	y	y	y	
Townsend's solitaire	*Myadestes townsendii*	y	y		
Townsend's warbler	*Dendroica townsendii*		y		
Tree swallow	*Tachycineta bicolor*	y	y		
Trumpeter swan	*Cygnus buccinator*	y			
Tundra swan	*Cygnus columbianus*		y		
Turkey	*Meleagris gallopavo*	y			
Turkey vulture	*Cathartes aura*	y	y		y
Veery	*Catharus fuscescens*	y	y		
Vesper sparrow	*Pooecetes gramineus*	y	y		y
Violet-green swallow	*Tachycineta thalassina*	y	y		y
Virginia's warbler	*Vermivora virginiae*	y	y		
Warbling vireo	*Vireo gilvus*	y	y		
Western grebe	*Aechmophorus occidentalis*	y	y		
Western kingbird	*Tyrannus verticalis*	y	y		
Western meadowlark	*Sturnella neglecta*	y	y		y
Western sandpiper	*Calidris mauri*	y	y		
Western scrub-jay	*Apheloma californica*		y	y	
Western tanager	*Piranga ludoviciana*	y	y		
Western wood-peewee	*Cantopus sordidulus*	y	y		
White-breasted nuthatch	*Sitta carolinensis*		y		
White-crowned sparrow	*Zonotrichia leucoophrys*	y	y		
White-faced ibis	*Plegadis chihi*	y	y		y
White-throated swift	*Aeronautes saxatalis*	y	y		
White-winged crossbill	*Loxia leucoptera*		y		
Willet	*Catotrophorus semipalmatus*	y	y		y
Williamson's sapsucker	*Sphyrapicus thyroideus*		y	y	
Willow flycatcher	*Empidonax traillii*		y		
Wilson's phalarope	*Phalaropus tricolor*	y	y	y	y
Wilson's warbler	*Wilsonia pusilla*	y	y		
Wood duck	*Aix sponsa*		y		
Yellow warbler	*Dendroica petechia*	y	y		
Yellow-breasted chat	*Icteria virens*	y	y		
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	y	y		y
Yellow-rumped warbler	*Dendroica coronata*	y	y		
AMPHIBIANS					
Boreal chorus frog	*Pseudacris triseriata maculata*	y	y		

Table D-1. Continued.

		Data Sources*			
Common Name	**Scientific Name**	**WOS**	**ATLAS**	**WYNDD**	**HWA**
Boreal toad	*Bufo boreas boreas*		y		
Great Basin spadefoot toad	*Scaphiopus intermontanus*		y		
Northern leopard frog	*Rana pipiens*		y	y	
Plains spadefoot toad	*Scaphiopus bombifrons*	y			
Tiger salamander	*Ambystoma tigrinum*	y	y		
REPTILES					
Eastern short horned lizard	*Phrynosoma douglassi brevirostre*	y	y		y
Great Basin gopher snake	*Pituophis melanoleucas deserticola*				y
Many-lined skink	*Eumeces multivirgatus*		y	y	
Northern sagebrush lizard	*Sceloporus graciosus graciosus*		y		y
Ornate box turtle	*Terrapene ornata ornata*		y		
Prairie lined racer	*Cnemidophorus sexlineatus viridis*	y			
Pale milk snake	*Lampropeltis triangulum multistrata*		y	y	
Prairie rattlesnake	*Crotalus vinidus vinidus*	y	y		y
Wandering garter snake	*Thamnophis elegans vagrans*	y	y		
Western plains garter snake	*Thamnophis radix haydeni*		y		
Western smooth green snake	*Opheodrys vernalis blanchardi*	y	y	y	

*Data Sources
- Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming (WGFD 1999)
- WGFD Wildlife Observation System (WGFD 2003)
- Wyoming Natural Diversity Database (2003)
- Hayden-Wing Associates Field Surveys 2000-2003

Table D-2. Fish species observed within the ARPA or that may potentially occur downsteam of the Atlantic Rim Project Area.

						Data Sources[2]				
Common Name	**Scientific Name**	**Game or Non game**	**Basin[1]**	**Present in ARPA**	**Native to ARPA**	**WYNDD**	**FOW**	**BLM**	**MCBMP**	**WSAM**
Bigmouth shiner	*Notropis dorsalis*	Non Game	NP				x			
Black bullhead	*Ameiurus melas*	Game	NP				x			
Black crappie	*Pomoxis maculatus*	Game	NP				x			
Bluegill	*Lepomis macrochirus*	Game	NP				x			
Bluehead sucker	*Catostomus discobolus*	Non Game	LSR	Yes	Yes	x	x	x	x	x
Bonneville cutthroat trout	*Oncorhynchus clarki utah*	Game	NP				x			
Bonytail	*Gila elegans*	Non Game	CR							
Brassy minnow	*Hybognathus hankinsoni*	Non Game	NP				x			
Brook trout	*Salvelinus fontinalis*	Game	NP, LSR, GDB	Yes			x	x	x	x
Brown trout	*Salmo trutta*	Game	NP, LSR				x			
Central stoneroller	*Campostoma anomalum*	Non Game	NP				x			
Channel catfish	*Ictalurus punctatus*	Game	NP, LSR				x			
Colorado pikeminnow	*Ptychocheilus lucius*	Non Game	LSR, CR				x	x		
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	Game	NP, LSR	Yes	Yes	x	x	x	x	x
Common carp	*Cyprinus carpio*	Game	NP, LSR, GDB				x	x		
Common shiner	*Luxilus cornutus*	Non Game	NP				x			
Creek chub	*Semotitus atromaculatus*	Non Game	NP, LSR	Yes			x	x	x	x
Emerald shiner	*Notropis atherinoides*	Non Game	NP				x			
Fathead minnow	*Pimephales promelas*	Non Game	NP				x	x		
Flannelmouth sucker	*Catostomus latipinnis*	Non Game	LSR	Yes	Yes	x	x	x	x	x
Flathead chub	*Platygobio gracilis*	Non Game	NP				x			
Freshwater drum	*Aplodinotus grunniens*	Non Game	NP				x			
Gizzard Shad	*Dorosoma cepedianum*	Non Game	NP				x			
Golden shiner	*Notemigonus crysoleucas*	Non Game	NP				x			
Golden trout	*Oncorhynchus aguabonita*	Game	NP				x			
Grass carp	*Ctenopharygodon idella*	Non Game	NP				x			
Grayling	*Thymallus arcticus*	Game	NP				x			
Green sunfish	*Lepomis cyanellus*	Game	NP			x	x			
Hornyhead chub	*Nocomis biguttatus*	Non Game	NP			x	x			
Humpback chub	*Gila cypha*	Non Game	CR							
Iowa darter	*Etheostoma exile*	Non Game	NP, LSR				x	x	x	x
Johnny darter	*Etheostoma nigrum*	Non Game	NP				x			
Kokanee	*Oncorhynchus nerka*	Game	NP				x			
Lake chub	*Couesius plumbeus*	Non Game	NP				x			
Lake trout	*Salvelinus namaycush*	Game	NP				x			
Largemouth bass	*Micropterus salmoides*	Game	NP				x			
Longnose dace	*Rhinichthys cataractae*	Non Game	NP, LSR	Yes			x		x	x
Longnose sucker	*Catostomus catostomus*	Non Game	NP, LSR				x			
Mottled sculpin	*Cottus bairdi*	Non Game	LSR	Yes	Yes		x	x	x	x
Mountain sucker	*Catostomus platyrhynchus*	Non Game	LSR	Yes	Yes		x	x	x	x
Mountain whitefish	*Prosopium williamsoni*	Game	LSR				x		x	x
Northern Pike	*Esox lucius*	Game	LSR							
Pallid Sturgeon	*Scaphirhynchus albus*	Game	PR						x	
Plains killifish	*Fundulus zebrinus*	Non Game	NP				x			
Plains topminnow	*Fundulus sciadicus*	Non Game	NP				x			
Pumpkin-seed	*Lepomis gibbosus*	Game	NP				x			
Quillback	*Carpiodes cyprinus*	Non Game	NP				x			
Rainbow trout	*Oncorhynchus mykiss*	Game	NP, LSR, GDB	Yes			x		x	x
Razorback sucker	*Xyrauchen texanus*	Non Game	CR							
Red shiner	*Cyprinella lutrensis*	Non Game	NP				x			
Redside shiner	*Richardsonius balteatus*	Non Game	LSR	Yes			x	x	x	x
River carpsucker	*Carpiodes carpio*	Non Game	NP				x			
Roundtail chub	*Gila robusta*	Non Game	LSR	Yes	Yes	x	x	x	x	x
Sand shiner	*Notropis stramineus*	Non Game	NP				x			
Shorthead redhorse	*Moxostoma macrolepidotum*	Non Game	NP				x			
Smallmouth bass	*Micropterus dolomieu*	Game	NP				x			
Snake River cutthroat trout	*Oncorhynchus clarki ssp.*	Game	NP				x			
Speckled dace	*Rhinichthys osculus*	Non Game	LSR	Yes	Yes		x	x	x	x
Splake	*Brook-Lake Trout Hybrid*	Game	NP				x			
Walleye	*Stizostedion vitreum*	Game	NP, LSR							x
White crappie	*Pomoxis annularis*	Game	NP				x	x		
White sucker	*Catostomus commersoni*	Non Game	NP, LSR	Yes			x	x		
Yellow perch	*Perca flavescens*	Game	NP				x			
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	Game	LSR				y			

[1]Basins
NP = North Platte River Basin
LSR = Little Snake River Basin
GDB = Great Divide Basin
CR = These species are downstream residents of the Colorado River Basin
PR = These species are downstream residents of the Platte River Basin
[2]Data Sources
- Wyoming Natural Diversity Database (WNDD 2003)
- Fishes of Wyoming (FOW) (Baxter and Stone 1995)
- Muddy Creek Basin Management Plan (MCBMP)(WGFD 1998)
- Warmwater Stream Assessment Manual (WSAM)(WGFD 2004)
- Mark Fowden, WGFD, personal communication (WGFD)
- Bureau of Land Management (BLM) (USDI-BLM 2001)

APPENDIX E:

WILDLIFE MONITORING AND PROTECTION PLAN

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WILDLIFE MONITORING AND PROTECTION PLAN
ATLANTIC RIM NATURAL GAS EIS

U.S. Bureau of Land Management
Rawlins Field Office
Rawlins, Wyoming

November 2005

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Table 2 Summary of General APD/ROW Application Stage Survey/Protection Measures

1.0 INTRODUCTION

This wildlife monitoring/protection plan was prepared in conjunction with the environmental impact statement (EIS) for the Atlantic Rim Natural Gas Project (ARNG). The goal of the plan is to avoid and/or minimize adverse impacts to wildlife present on project-affected areas by monitoring wildlife population trends on the ARNG during the course of project development and operations and by developing appropriate mitigation actions. Implementation of the plan will allow land managers and project personnel opportunities to achieve and maintain desired levels of wildlife productivity and populations on the ARNG (e.g., at pre-project levels) by minimizing and/or avoiding potential adverse impacts to wildlife species. In addition, the implementation of this plan will facilitate the maintenance of a diverse assemblage of wildlife populations on the ARNG simultaneously with development of natural gas reserves.

Proposed inventory, monitoring, and protection measures will be implemented under each potential development scenario. Implementation of the plan will begin in 2006, and is estimated to continue for the life of the EIS; however, the plan may be terminated at the end of any year when there is sufficient evidence that wildlife populations and productivity in the ARNG have been successfully protected. The plan will receive a major review for effectiveness every 5 to 6 years or as determined by the Review Team.

2.0 IMPLEMENTATION PROTOCOL

This section provides preliminary wildlife inventory, monitoring, and protection protocol. A summary of primary protocol components is provided in Table 1. Standard protocol for Application for Permit to Drill (APD) and right-of-way (ROW) application field reviews are provided in Table 2. Alternative protocols likely will be developed in the future in response to specific needs identified in annual reports (Section 2.1.1). Methods are provided for each wildlife species/category, and additional species/categories may be added based on needs identified in annual reports. The wildlife species/categories for which specific inventory, monitoring, and protection procedures will be applied were developed based on management agency (Bureau of Land Management [BLM], U.S. Fish and Wildlife Service [USFWS], Wyoming Game and Fish Department [WGFD]) and individual concerns identified during the preparation of the EIS.

Considerable efforts will be required by agency and operator personnel for plan implementation. Many of the annually proposed agency data collection activities are consistent with current agency requirements. Additionally, during annual planning (Section 2.1.2) and throughout project implementation, all efforts will be made to accommodate agency personnel schedules and responsibilities, and further agency cost-sharing approaches will be considered such that public demands and statutory directives are achieved.

2.1 ANNUAL REPORTS AND MEETINGS

2.1.1 Reports

During project development, operators will provide an updated inventory and description of all existing project features (i.e., location, size, and associated level of human activity at each feature), as well as those tentatively proposed for development during the next 12 months in a format that is

compatible with a Geographic Information System (GIS). This inventory will be submitted to the BLM by operators no later than October 15 of each calendar year. These data will be coupled with annual wildlife inventory, monitoring, and protection data obtained for the previous year and included in annual reports. Annual reports will be prepared by the operators' third party contractor with BLM oversight. Annual wildlife inventory, monitoring and protection data gathered in conjunction with the project will be provided to the BLM by October 15 of each calendar year.

Annual reports will summarize annual wildlife inventory and monitoring results, note any trends across years, identify and assess protection measures implemented during past years, specify monitoring and protection measures proposed for the upcoming year, recommend modifications to the existing wildlife monitoring/protection plan based on the successes and/or failures of past years and identify additional species/categories to be monitored. Where possible, the data presented in reports will be used to identify potential correlations between development and wildlife productivity and/or abundance, as well as, sources of potential disturbance to wildlife. A GIS will be used for information storage, retrieval, planning, and annual GIS data updates will be conducted. Raw data collected each year also will be provided to other management agencies, at the request of the agencies.

Annual reports will be completed in draft and submitted to the BLM, operators and other interested parties by November 15 of each year. A final annual report will be issued to all potentially affected individuals and groups by early February of each year. Additional reports may be prepared in any year, as necessary, to comply with other relevant wildlife laws, rules, and regulations.

2.1.2 Meetings

A one day meeting will be organized by the BLM and held in December (or as determined by the Review Team) of each year to discuss and modify, as necessary, proposed wildlife inventory, monitoring and protection protocol for the subsequent year. Decisions regarding annual operator-specific financing and personnel requirements will be made at these meetings. A protocol regarding how to accommodate previously unidentified development sites will also be determined during the annual meeting. Final decisions will be made by the BLM based on the input of all affected parties.

Additional meetings may be held in any given year to inform and update cooperators on the findings of additional reports, as necessary.

2.2 ANNUAL INVENTORY AND MONITORING

Inventory and monitoring protocols will be as identified below for each wildlife species/category. These protocols will be unchanged across development alternatives, except as authorized by the BLM or specified in this plan. Additional wildlife species/categories and associated surveys may be added or wildlife species/categories and surveys may be omitted in future years, pending results presented in the coordinated review of annual reports. Opportunistic wildlife observations may be made throughout the year by agency and operator personnel present in the project area.

The frequency of inventory and monitoring will be dependent upon the level of development in the project area. In general, inventory and monitoring frequency will increase with increased levels of development. Inventory and monitoring results may lead to further, currently unidentifiable, scientific studies specifically designed to determine cause and effect. The review team and/or BLM will identify the level of effort required by this wildlife plan subject to the standard listed below. Site-

and species-specific surveys will be conducted in association with APD and ROW application field reviews.

2.2.1 Threatened, Endangered, Candidate, and Other Species of Concern

The level of inventory/monitoring required for threatened, endangered, candidate, and other species of concern (TEC&SC) will be commensurate with established protocols for the potentially affected species. All surveys will be conducted in coordination with the BLM. Methodologies and results of these surveys will be included in annual reports and provided in separate supplemental reports. A preliminary list of TEC&SC species proposed for management and known from or potentially occurring in the vicinity of the project area is shown Chapter 3. As TEC&SC species are added to or withdrawn from USFWS, BLM, and/or WGFD lists, appropriate modifications will be incorporated to this plan and specified in annual reports.

TEC&SC data collected during surveys and described below will be provided only as necessary to those requiring the data for specific management and/or project development needs. Site- and species-specific TEC&SC surveys will be conducted as necessary in association with all APD and ROW application field reviews.

2.2.1.1 Black-footed Ferret

The USFWS, in coordination with the WGFD, has developed a list of habitat blocks that are not likely to be inhabited by black-footed ferrets (block cleared). In these areas, take of individual ferrets and effects to a wild population are not an issue and surveys for ferrets are no longer recommended. Although ferret surveys are not required in these areas, the area may still maintain value for the survival and recovery of the species in the future. Additionally, areas remain that require ferret surveys (non-block cleared) in potential habitat. A portion of the project area coincides with the Dad complex, which is a non-block cleared area, requiring ferret surveys in areas that would likely result in the take of a ferret during project implementation.

BLM biologists will determine the presence/absence of prairie dog colonies at each proposed development site during APD and ROW application field reviews. Prairie dog colonies in the project area will be mapped and burrow densities determined by a BLM-approved operator-financed biologist, as necessary and in association with proposed development plans. Colonies that meet USFWS criteria as potential black-footed ferret habitat (USFWS 1989), in non-block cleared areas, will be surveyed for black-footed ferrets by an USFWS-certified operator-financed surveyor prior to BLM authorizing disturbance of these colonies. Surveys will be conducted as deemed necessary, during consultation with the BLM and/or USFWS. Black-footed ferret surveys will be conducted in accordance with USFWS guidelines (USFWS 1989) and approved by BLM and USFWS.

2.2.1.2 Bald Eagle, Peregrine Falcon, and Ferruginous Hawk

Inventory and monitoring protocol for bald eagle, peregrine falcon, and ferruginous hawk will be as described for raptors (Section 2.2.1).

2.2.1.3 Greater Sage-Grouse & Columbian Sharp-Tailed Grouse

Greater sage-grouse/Columbian sharp-tailed grouse lek inventories will be conducted by the BLM and Wyoming Game & Fish Department on the project area and a two mile/one mile buffer to determine lek locations every 5 years, or as deemed appropriate by the BLM. Surveys may be

conducted aerially, with operator-provided financial assistance for aircraft rental, or on the ground, in order to determine lek locations.

Selected leks within two miles/one mile of existing and proposed disturbance areas will be monitored annually to determine lek attendance by the BLM or a BLM-approved operator-financed biologist, between March 1 and May 15, such that all leks on these areas are monitored at least once every 3 years. Monitoring efforts will be implemented at all leks present on affected sections, two mile buffers, and selected undeveloped comparison areas. The BLM will direct lek monitoring efforts such that efforts are made to have the same individuals monitor the same leks within and across years. Data collected during these surveys will be provided on a standardized form. Standard site- and species-specific grouse lek surveys will be conducted as necessary in association with all APD and ROW application field reviews.

2.2.1.4 Mountain Plover

Mountain plover habitat will be mapped within proposed disturbance areas (as identified in annual reports) prior to development of these areas by the BLM or a BLM-approved operator-financed biologist. In addition, these areas will be surveyed annually by the BLM or a BLM-approved operator-financed biologist to detect the presence of plovers. Surveys will be conducted during the period of May 1 through June 30. Data collected during these surveys will be provided on mountain plover route survey forms. Standard site-specific habitat surveys will be conducted as necessary in association with all APD and ROW application field reviews.

2.2.1.5 Western Burrowing Owl

Prairie dog colonies and other suitable burrowing owl nesting areas on and within 0.75 miles of existing and proposed disturbance areas will be searched for western burrowing owls by the BLM or a during June through August to determine the presence or absence of nesting owls. If burrowing owls are found, attempts will be made to determine reproductive success. Standard site-specific surveys will be conducted in association with all APD and ROW application field reviews.

2.2.1.6 Other TEC&SC Species

Surveys for other TEC&SC species will be conducted by the BLM or a BLM-approved operator-financed biologist in areas of potential habitat within 0.5 mile of proposed disturbance sites prior to disturbance. These surveys may be implemented in conjunction with surveys for other species or as components of APD and/or ROW application processes. If any TEC&SC species are observed, the observations will be noted on appropriate data forms and efforts will be made to determine their activities (e.g., breeding, nesting, foraging, hunting, etc.). If any management agency identifies a potential for concern regarding any of these species, additional inventory and monitoring and mitigation may be implemented as specified in annual reports.

2.2.2 Raptors

Raptor inventories will be conducted by the BLM, at least every five years or prior to development of proposed disturbance areas (as identified in annual reports), to determine the location of raptor nests. Raptor nest monitoring will be conducted by the BLM or a BLM approved operator-financed biologist, annually, at known nest locations, between April and July, in order to ascertain nest activity status. These surveys may be implemented aerially, via helicopter, or from the ground. Operators may provide financial assistance for aircraft rental.

Nest productivity monitoring will be conducted by the BLM at active nests, for selected species, to determine nesting success. Monitoring generally will be conducted from the ground, and attempts will be made to determine the cause of any documented nest failure. Operators may provide financial assistance for aircraft rental, as necessary. Site- and species-specific raptor nest inventories will be conducted as necessary in association with all APD and ROW application field reviews.

All raptor nest/productivity surveys will be conducted using procedures that minimize potential adverse effects to nesting raptors. Specific survey measures for reducing detrimental effects are listed in Grier and Fyfe (1987) and Call (1978) and include the following.

- Nest visits will be delayed for as long as possible in the nesting season.
- Nests will be approached cautiously, and their status (i.e., number of nestlings/fledglings) will be determined from a distance with binoculars or a spotting scope.
- Nests will be approached tangentially and in an obvious manner to avoid startling adults.
- Nests will not be visited during adverse weather conditions (e.g., extreme cold, precipitation events, windy periods, and hottest part of the day).
- Visits will be kept as brief as possible.
- All inventories will be coordinated by the BLM.
- The number of nest visits in any year will be kept to a minimum.
- All raptor nest location data will be considered confidential.

2.2.3 Big Game Crucial Winter Range

Data on big game use of crucial winter ranges on the project area and an adjacent one mile buffer will be requested annually by the BLM from the WGFD, as deemed necessary by the BLM. This information will be used to assess the effectiveness of protection measures implemented for the project.

2.2.4 Other Inventory and Monitoring Measures

Additional inventory and monitoring measures may be applied for other species as specified in annual reports. Surveys will be conducted in adherence with protocol to be established by the BLM, other agencies and operators. Operators may provide financial assistance for these investigations.

2.2.5 General Wildlife

BLM staff will be responsible for maintaining records of selected wildlife species observed during the course of their activities on the project area. Operator personnel may also provide data on wildlife observations. The information provided will include observations of wildlife species, their numbers, location, activity, and other pertinent data as applicable and identified on the General Wildlife Observation Data Sheet. Where operators are uncertain of the USGS coordinates for an observation, a general description of the location may be provided and in instances where species or sex information is questionable, operators will identify the observation as such.

2.3 PROTECTION MEASURES

The wildlife protection measures proposed herein have been developed from past measures identified for oil and gas developments in Wyoming. Additional measures may be included and/or

existing measures may be modified in any given year as allowable and as deemed appropriate by BLM in consultation with other agencies, operators and interested parties. These measures will be specified in annual reports. Protection measures will be implemented by operators with assistance from and/or in consultation with the BLM. In addition, these measures may be modified on a site-specific basis as deemed appropriate by the BLM after completion of APD and ROW application field reviews.

The principal protection measure for most wildlife will be species- and project-specific measures as well as general wildlife protection measures (Section 2.3.4). Implementation of these measures may benefit other wildlife species found on and adjacent to the project area. Sensitive/crucial habitats should be avoided where possible.

2.3.1 TEC&SC

USFWS and WGFD consultation and coordination will be conducted for all protection activities relating to TEC&SC species and their habitats. Where possible, these actions will be specified in advance in the annual reports.

2.3.1.1 Black-footed Ferret

In general, all prairie dog colonies on the project area will be avoided, where practical. If prairie dog colonies, in non-block cleared areas, of sufficient size and burrow density for black-footed ferrets are scheduled to be disturbed, black-footed ferret surveys of these colonies will be conducted pursuant to BLM and/or USFWS decisions made during informal consultations. Survey protocol will adhere to USFWS guidelines as established in USFWS (1989) and will be conducted by a USFWS-qualified biologist a maximum of one year in advance of the proposed disturbance. Reports identifying survey methods and results will be prepared and submitted to the USFWS and BLM in accordance with Section 7 of the *Endangered Species Act of 1973*, as amended, and the Interagency Cooperation Regulations. Surveys will be financed by the operators.

If black-footed ferrets are found on the project area, the USFWS will be notified immediately and formal consultations will be initiated to develop strategies that ensure no adverse effects to the species. Before ground-disturbing activities are initiated in black-footed ferret habitat, authorizations to proceed must be received from the BLM, in consultation with the USFWS.

2.3.1.2 Bald Eagle, Peregrine Falcon, and Ferruginous Hawk

Protection protocol will be as described for raptors (see Section 2.3.1). Additional measures will be applied on a species- or site-specific basis, as deemed appropriate by the BLM and/or USFWS, and specified in annual reports.

2.3.1.3 Greater Sage-Grouse & Columbian Sharp-Tailed Grouse

Surface disturbance or occupancy will be prohibited with 0.25 miles of the perimeter of occupied leks; Human activity would be avoided between 6:00 p.m. and 9:00 a.m. from March 1 to May 20 within 0.25 miles of the perimeter of occupied leks; Surface disturbance and other actions that create permanent and high-profile structures such as buildings, storage tanks and overhead power lines, will not be constructed within 0.25 to1.0 mile of the perimeter of leks, as determined on a case-by-case basis; Surface disturbing and disruptive activities will not be allowed within two miles of an occupied greater sage-grouse lek or in nesting and early brood-rearing habitat associated with

individual leks (when identified and delineated), from March 1 to July 15; Surface disturbing and disruptive activities will not be allowed within one mile of an occupied Columbian sharp-tailed grouse lek or in nesting and early brood-rearing habitat associated with individual leks (when identified and delineated), from March 1 to July 15; Surface disturbing and disruptive activities will not be allowed between November 15 and March 14 in delineated winter concentration areas; and, in order to minimize noise disturbances to strutting or dancing grouse, compressor stations and generators will be muffled with hospital style mufflers. Other techniques and/or equipment can be utilized, when it is demonstrated that they result in similar or increased noise reduction. Additional noise reduction techniques may be required if research shows that current techniques are not adequate.

2.3.1.4 Mountain Plover

Mountain plover habitat will be avoided where practical. Where these habitats will be disturbed, reclamation will utilize procedures designed to reestablish suitable plover habitat. The primary protection measure for mountain plover on the project area will be avoidance plover habitat during the breeding season. All surface-disturbing activities will be restricted from April 10 to July 10 in mountain plover habitat. Additional protection measures, as shown below, may be implemented in identified mountain plover occupied habitat (i.e., areas where broods and/or adults have been observed in the current year or documented in at least 2 of the past 3 years). Surface disturbance would occur outside identified occupied habitat for mountain plovers where feasible.

- Within ½ mile of the identified mountain plover occupied habitat area; speed limits would be posted at 25 mph on resource roads and 35 mph on local roads during the brood rearing period (June 1 - July 10).
- The access road would be realigned to avoid the identified mountain plover occupied habitat area.
- To protect mountain plover in occupied habitat, traffic would be minimized from June 1 - July 10 by car-pooling and organizing work activities to minimize trips on roads through the mountain plover occupied habitat area.
- To protect mountain plover in occupied habitat, fences, storage tanks, and other elevated structures would be either constructed as low as possible and/or would incorporate perch-inhibitors into their design.
- To minimize destruction of nests and disturbance to breeding mountain plovers, no ground-disturbing activities would occur from April 10 - July 10 unless surveys consistent with the Plover Guidelines or other FWS approved method find that no plovers are nesting in the area.
- A plugged and abandoned well within ½ mile of the identified mountain plover occupied habitat area would be identified with a marker 4 feet tall with a perch inhibitor on the top of the marker.

2.3.1.5 Western Burrowing Owl

Protection protocol will be as described for raptors (Section 2.3.1) as well as avoidance of prairie dog colonies, where practical (Section 2.3.2.1).

2.3.1.6 Other TEC&SC Species

If crucial features for any TEC&SC species are found during surveys of areas within 0.5 miles of proposed disturbance sites, avoidance of these features will be accomplished in consultation and

coordination with the BLM, USFWS, and WGFD. Construction activities in these areas will be curtailed until there is concurrence between BLM, USFWS, and WGFD on what activities can be authorized. Activities will, in most cases, be delayed until such time that no adverse effects will occur.

It is assumed that the protocol specified in Section 2.3.4 for general wildlife will likely benefit TEC&SC species as well. If any management agency identifies a potential for impacts to any TEC&SC species, additional measures may be implemented as specified in annual reports.

2.3.2 Raptors

The primary protection measure for raptor species on the project area will be avoidance of nest locations during the breeding season. All surface-disturbing activities will be restricted from February 1 through September 15 within a 0.75 to 1.0 mile radius of raptor nests, depending upon species. In addition, well locations, roads, ancillary facilities, and other surface structures requiring a repeated human presence will not be constructed within 825 feet of raptor nests, except ferruginous hawk, where the restriction will be 1,200 feet (restrictions will generally exclude surface disturbance).

Operators will notify the BLM immediately if raptors are found nesting on or within 1,200 feet of project facilities, and operators will assist the BLM as necessary in erecting artificial nesting structures (ANSs), as appropriate. The use of ANSs will be considered as a last resort for raptor protection. If nest manipulation or a situation requiring a "taking" of a raptor nest becomes necessary, a special permit will be obtained from the Denver USFWS Office, Permit Section, and will be initiated with sufficient lead time to allow for development of mitigation. Required corresponding permits will be obtained from the WGFD in Cheyenne. Consultation and coordination with the USFWS and WGFD will be conducted for all protection activities relating to raptors.

If it is found that project activities could potentially affect raptor nesting on or adjacent to the project area, as determined from decreased raptor productivity or nesting, or documented nest abandonment or failure, ANSs may be constructed at a rate of up to two ANSs for one impacted nest. Existing degraded raptor nests may be upgraded or reinforced to minimize potential impacts. ANSs will be located within the nesting territory of potentially affected raptor pairs, outside of the line-of-sight or nest buffer of actively nesting pairs, where possible. Operators will be responsible for the annual maintenance of ANSs throughout the LOP. Annual ANS maintenance activities will be completed after August 15 and prior to October 15 each year, as necessary. All ANSs on public lands will become the property of the BLM upon completion of the project. Pertinent data regarding ANSs or nests proposed for upgrading will be identified in annual reports.

In cases where existing project features are located within the nest buffers of active raptor nests, no prolonged maintenance activities will be allowed during critical periods. The exact dates of exclusion will be determined by the BLM and will likely vary between nests and from year to year, depending on the species present and variations in weather, nesting chronology, and other factors.

Any power line construction will follow the recommendations of the Avian Power Line Interaction Committee (APLIC) (1994, 1996) and Olendorff et al. (1981) to avoid collisions and/or electrocution of raptors.

2.3.3 Big Game Species

No construction activities or prolonged maintenance actions will be conducted within big game crucial winter range during the crucial winter periods of November 15 - April 30. If right-of-way fencing is required, it will be kept to a minimum, and the fences will meet BLM/WGFD approval for facilitating wildlife movement. Wildlife-proof fencing will be used only to enclose areas that are potentially hazardous to wildlife species, or reclaimed areas where it is determined that wildlife species are impeding successful vegetation establishment. Snow fences, if used, will be limited to segments of 0.25 miles or less. Project personnel will also be advised to minimize stopping and exiting their vehicles in big game winter habitat during crucial winter periods. In addition, escape openings will be provided along roads in big game crucial winter ranges, as designated by the BLM, to facilitate exit of big game animals from snowplowed roads. Additional habitat protection/improvement measures may also be applied in any given year as directed by the BLM, in consultation with operators and other agencies, and specified in annual reports.

2.3.4 General Wildlife

Unless otherwise indicated, the following protection measures will be applied for all wildlife species. Additional measures primarily designed to minimize impacts to other resources (e.g., vegetation and surface water resources, including wetlands, steep slopes, etc.) are identified in the EIS in Chapter 4.0, and these measures may provide additional protection for wildlife. Additional actions may be applied in any given year to further minimize potential impacts to wildlife. These actions will be specified in annual reports.

All roads on and adjacent to the project area that are required for the proposed project will be appropriately constructed, improved, maintained, and signed to minimize potential wildlife/vehicle collisions and facilitate wildlife (most notably big game) movement through the project area. Appropriate speed limits will be adhered to on all project roads, and operators will advise employees and contractors regarding these speed limits. Some existing roads on the project area and surrounding transportation planning area may be reclaimed if they become redundant, or closed (gated and locked, year-round or seasonally) to deny unnecessary access.

To protect important habitat in portions of the project area (i.e., ephemeral draws dominated by basin big sagebrush) areas with sagebrush greater than three feet tall will be avoided where possible.

Additional non-species-specific wildlife mitigations include the following.

- Reserve, work-over, and flare pits and other locations potentially hazardous to wildlife will be adequately protected by netting and/or fencing as directed by the BLM to prohibit wildlife access.
- If dead or injured raptors, big game, migratory birds, or unusual wildlife are observed on the project area, operator personnel will contact the appropriate BLM and WGFD offices. Under no circumstances will dead or injured wildlife be approached or handled by operator personnel.
- Employee and contractor education will be conducted regarding wildlife laws. If violations are discovered on the project area, operators will immediately notify the appropriate agency. If the violation is committed by an employee or contractor, said employee or contractor will be disciplined and may be dismissed by the operator and/or prosecuted by the WGFD and/or USFWS.
- Operators will implement policies designed to control off-site activities of operational personnel and littering, and will notify all employees (contract and company) that conviction of a violation can result in disciplinary action, including dismissal.

Additional project- and site-specific mitigation measures may be added in future years, as specified in annual reports.

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Table 1 Summary of General Wildlife Reporting, Inventory, and Monitoring

ACTION	DATES	RESPONSIBLE ENTITY
Annual tentative plan of development	By October 15, annually	Operator
Annual inventory, monitoring and protection data	By October 15, annually	
Annual reports	Annually: Draft – early November Final – early January	Operator
Annual meeting	December and as necessary	BLM with participation by other agencies and operators
INVENTORY/ MONITORING		
Raptor nest inventory	At least every five years, prior to development	BLM or BLM approved operator financed biologist with operator provided financial assistance for aircraft rental, as necessary
Raptor monitoring	Annually from April to July	BLM or BLM approved operator financed biologist with operator provided financial assistance for aircraft rental, as necessary
Greater sage-grouse & Columbian sharp-tailed grouse lek inventory	At least every five years	BLM or BLM approved operator financed biologist with operator provided financial assistance for aircraft rental, as necessary
Greater sage-grouse & Columbian sharp-tailed grouse lek monitoring	Annually from March to mid-May	BLM or BLM approved operator financed biologist
Big game crucial winter range use/monitoring	As available	BLM will request data from WGFD
Mountain Plover surveys	Annually from May to June	BLM or BLM approved operator financed biologist

Table 2 Summary of General APD/ROW Application Stage Survey/Protection Measures

PROTECTION MEASURE	DATES	RESPONSIBLE ENTITY
Raptor nest survey/inventory within 0.75 to 1.0 miles of proposed disturbance	Yearlong	BLM, operator
Raptor nest season avoidance within 0.75 to 1.0 miles	February 1 to September 15	BLM, operator
Raptor nest avoidance with 825 feet (1200 feet for ferruginous hawk nests)	Yearlong	BLM, operator
TEC&SC surveys	Yearlong, as necessary	BLM, operator
TEC&SC avoidance	Yearlong, as necessary	BLM, operator
Prairie dog colony mapping	Yearlong, as necessary	BLM, operator
Prairie dog colony avoidance	Yearlong, where practical	BLM, operator
Black-footed ferret surveys	As appropriate in accordance with USFWS guidelines	Operator financed USFWS-approved biologist
Mountain Plover habitat surveys	Yearlong	BLM, operator
Mountain plover nest/brood avoidance	April 10 to July 10	BLM, operator
Greater sage-grouse lek/nesting habitat avoidance within 2.0 miles of proposed disturbance; Columbian sharp-tailed grouse lek/nesting habitat avoidance within 1.0 mile of proposed disturbance	March 1 to June 30	BLM, operator
Greater sage-grouse and Columbian sharp-tailed grouse lek avoidance within 0.25 miles of proposed disturbance	Yearlong	BLM, operator
Big game crucial winter range avoidance	November 15 to April 30	BLM, operator
General wildlife avoidance/protection	As necessary	BLM, other agencies, operator

APPENDIX G

BIOLOGICAL ASSESSMENT OF THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES FOR THE ATLANTIC RIM NATURAL GAS PROJECT

Biological Assessment
of
Threatened, Endangered, Proposed, and Candidate Species
for the
Atlantic Rim Natural Gas Project

Prepared by

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APPENDIX G – BIOLOGICAL ASSESSMENT

1.0 Project Description

This Biological Assessment (BA) discusses the potential effects of the proposed Atlantic Rim Natural Gas Project on threatened, endangered, and proposed species pursuant to the Endangered Species Act (ESA) of 1973. Candidate species for listing under the ESA are also discussed. This BA also presents recommendations to assure that the construction and subsequent operation of the proposed project will neither jeopardize the continued existence of those species nor result in the destruction or adverse modification of their critical habitats. Analysis of effects of this proposed project on threatened, endangered, and proposed species complies with the provisions of the ESA. The Bureau of Land Management (BLM) maintains an interest in protecting candidate species under their sensitive species policy (BLM Manual 6840), with the goal that actions on BLM administered lands consider the welfare of these species and do not contribute to the need to list any of the sensitive species under the provisions of the ESA.

Anadarko Petroleum Company has notified the BLM, Rawlins Field Office that Anadarko and other cooperators intend to drill additional exploration and development wells within the Atlantic Rim Project Area (ARPA). While the Atlantic Rim Environmental Impact Statement (EIS) is being prepared, BLM has allowed the interim drilling of about 116 natural gas wells in six pod locations within the ARPA. The objective of the interim drilling program is to allow the ARPA operators to drill, complete, and produce the wells to determine which geologic objectives are gas productive, which drilling and completion techniques are economical, if dewatering of the drilling objectives can be achieved, and what depths or pressure windows may be preferred to target economic gas production. In addition to those wells drilled under the Atlantic Rim IDP, 210 previously approved wells, with accompanying production-related facilities, also exist within the ARPA.

Four alternatives have been developed for the proposed project: the Proposed Action, Alternative A (no action), Alternative B (sequential development), and Alternative C (spatial). Descriptions of each alternative are discussed in detail in Chapter 2 of the Draft Environmental Impact Statement (DEIS) (USDI-BLM 2005) and are summarized below.

Proposed Action

The proponents for the Atlantic Rim project propose the following:

- The Proposed Action consists of drilling approximately 1,800 CBNG wells to and throughout the Mesa Verde formation targeting the coals. In addition, approximately 200 conventional gas wells targeting sands at deeper depths are proposed throughout the project area, totaling 2000 wells all together. The planned production and development activities would occur primarily in and adjacent to the existing POD locations.

- The drilling activities for the 2,000 natural gas wells would be in addition to the approximately 116 ARPA exploration wells drilled during the interim drilling period. Also, this proposal is in addition to the 210 existing wells previously approved by the BLM for drilling to deeper, conventional formations in the ARPA prior to this proposed action.

- Proposed well spacing is 8 wells per section (80 acre spacing) throughout the project area and may be reduce to 4 wells per sections dependent on the geology and ability to release the water and pressure sufficient to release and recover the gas.

- Development would begin in 2006 (subsequent to the release of the Record of Decision) within the ARPA and continue for approximately 20 years, with a life-of-project (LOP) of

30-50 years. Various drilling and production related facilities (e.g., roads, pipelines, water wells, disposal wells, compressor stations, and gas processing facilities) would also be constructed throughout the ARPA. The proposed action does not include any overhead or newly buried electrified lines.

- Under the proposed action, there would be approximately 4,500 acres of new short term (initial) surface disturbance from well pad locations and associated facilities 1,000 miles (approximately 9,700 acres) of new roads or upgrades of existing roads; 1,015 miles (about 5,460 acres) of new gathering gas and water pipelines; and 1,480 acres of ancillary facilities. The total new short-term (initial) disturbance resulting from the proposed action would be about 15,800 acres.

- Under the Proposed Action, planned reclamation would reduce the total acres of disturbance to 6,241 acres of long term (LOP) disturbance.

Alternative A – No Action

NEPA regulations require that EIS alternative analyses in the EIS "include the alternative of no action" (40 CFR 1502.14(d))." For this analysis, "no action" means that the BLM would reject the Proponent's' proposal and "the proposed activity would not take place".

Alternative B – Sequential Development

Alternative B involves the same number and spacing of wells to be drilled as in the proposed action. However, the principle difference would be that the of development (drilling and associated construction activity) would occur in three phases with the center portion of the project area (vicinity of Doty Mountain Pod, Sundog / Cow Creek Pod and Blue Sky Pod) being developed first over a 6 to 7 year period. As in the proposed action, the entire project area would eventually be developed over the planned twenty year period. The initial phase would involve up to 925 well locations within the Phase 1 portion of the project area. Once completed and in production, development would then be shifted to the second phase in the northern portion of the project area and lastly, the third phase in the southern portion of the project area would be developed. The boundary between Phase 1 and Phase 2 lies along Muddy Creek and the boundary between Phase 1 and Phase 3 lies along a watershed divide and is delineated to keep intact a mule deer migration corridor based on data from the Wyoming Game and Fish Department. There would be continued drilling within previously analyzed PODs under the existing interim drilling plan concurrently with development of the initial phase. However, this drilling and facility development would be limited.

Under this alternative, development would be concentrated to one third of the project area at any one time, thereby concentrating surface disturbing activities, such as traffic and noise. Each phased area or zone would contain two to three of the original PODs from the interim drilling program. The center, Phase 1 area, containing of the Doty Mountain, Cow Creek/Sun Dog, and Blue Sky PODs, would be the first to be developed. The other two zones would be in-active in the sense that construction activities would not occur Development in those areas would not commence until drilling and interim reclamation operations are completed in the first phase areas and then the next.

POD boundaries would remain the same as they exist and were originally proposed. No additional development would occur outside the POD boundaries in inactive zones. BLM would authorize suspensions of operations and production for all leases within the no-activity areas except for where existing oil and gas development has already occurred. Proposals to develop

leases within non-active zones would be denied until the zone in which it is located becomes active for development under the Atlantic Rim ROD. For those leases suspended by the BLM no lease rental fees would accrue and the lease term will be tolled during the period the zone remained in a "no activity" status. Active status would last from 6-7 years per zone and would include completion of interim reclamation.

Gas production operations would begin and continue within an active zone as construction occurs. The extent of gas production facilities would continue to accumulate as time passes with ultimately the same level of operational (production) disturbance as the other action alternatives at completion. Once developed, production would continue throughout the project area.

Alternative C - Spatial
Development for natural gas would occur as in the proposed action, but would be conditioned with the application of required development protection measures in those areas with sensitive or crucial resource values. Generally, constraints would focus on surface disturbance limits, limited operating periods, modification of drilling and construction practices, and, in some cases, no surface occupancy. Resource data, in the form of GIS layers, would be used to identify specific areas of resource concern. Examples of such areas are: unique cultural values, crucial wildlife and fish habitat, and areas with fragile soils. These types of areas are unique enough to require additional protective measures beyond what is already provided by applying the standard Best Management Practices (BMPs) (Appendices H and J), lease stipulations, and Conditions of Approval (COAs). As a end product, geographic information system (GIS) layers would be available to operators for development of site specific proposals for their planning of the annual program of work. Further details on development protection measures proposed are detailed in Chapter 2, Alternative C.

1.1 Project Area Location

The ARPA is located in the southwestern corner of Wyoming's Carbon County, within Townships 13 through 20 North (T13-20N) and Ranges 89 through 92 West (R89-92W) of the 6th principal meridian. The project area encompasses approximately 270,000 acres. Of this total, approximately 174,000 acres are managed by the U.S. Department of the Interior (USDI) BLM; 14,000 acres are managed by the State of Wyoming; and about 82,000 acres are private lands. A detailed description of the project area location can be found in Section 1.1 of the DEIS (USDI-BLM 2005).

2.0 Methods

The assessments and recommendations contained within this BA are based upon information obtained from several sources: (1) published literature, (2) unpublished agency reports and data, (3) personal communications with state and federal agency wildlife specialists, (4) meetings with state and federal agency plant and wildlife specialists, and (5) field surveys.

2.1 Published Literature

Published scientific documents that pertain directly to the specific circumstances and issues involved in this analysis were reviewed and incorporated into this BA. All published literature used in this assessment is appropriately cited.

2.2 Unpublished Agency Reports and Data

Unpublished documents and data sets from the files of the Wyoming Game and Fish Department (WGFD) and U.S. Fish and Wildlife Service (FWS) were reviewed, utilized, and referenced in this BA. All available information on threatened and endangered species in the project area was reviewed in the preparation of the DEIS and this document. Materials reviewed include distribution and habitat maps, progress reports, recovery plans, sighting records, management plans, and survey guidelines for threatened and endangered species.

Some information concerning historical wildlife usage of the project area was obtained through the Rawlins BLM Field Office and District IV biologists of the WGFD. This information was specific to current and historical locations for wildlife species. Additional information was obtained from the WGFD, which maintains a computerized listing of all wildlife species reported in an area. This listing, known as the Wildlife Observation System (WOS) was accessed for information concerning all species of wildlife (birds, mammals, amphibians, and reptiles) that have been observed and recorded within the ARPA and a township buffer (T12-21N, R88-93W) as residents or seasonal migrants. The Wyoming Natural Diversity Database (WYNDD) was also queried for reports of rare or unique plant and wildlife species within the ARPA.

2.3 Personal Communications

Individuals interviewed during the fact-finding process, either directly or by telephone, included: Mr. Frank Blomquist (BLM Wildlife Biologist, Rawlins, WY), Ms. Pat Deibert (FWS Biologist, Cheyenne, WY), Ms. Kathleen Erwin (FWS Biologist, Cheyenne, WY), Mr. Walt Fertig (WYNDD Heritage Biologist, Laramie, WY), Ms. Mary Read (BLM Wildlife Biologist, Rawlins, WY), Mr. Andy Warren (BLM Supervisory Rangeland Management Specialist, Rawlins, WY), Mr. Greg Hiatt (WGFD Wildlife Biologist, Sinclair, WY) and Mr. Tim Woolley (WGFD Wildlife Biologist, Baggs, WY).

2.4 Meetings

Numerous meetings were held among state and federal wildlife specialists and Hayden-Wing Associates (HWA) concerning potential impacts to wildlife that may result from the proposed project. All of the concerns raised in these meetings regarding development of the proposed project have been addressed in either this document or the DEIS (USDI-BLM 2005).

2.5 Field Surveys

Existing special status wildlife information for the project area was supplemented through wildlife surveys conducted by HWA from 2000 to 2004. These data collections consisted of aerial and ground surveys to determine: (1) occurrence of threatened, endangered, proposed, candidate, or sensitive species and/or habitat that may occur on the project area; (2) the occurrence, location, size, and burrow density of white-tailed prairie dog colonies; and (3) the location and activity status of raptor nests within the project area and one-mile buffer zone.

2.6 BA Preparation

Personnel who cooperated in the preparation of this BA include the following: L.D. Hayden-Wing, principal investigator of HWA and a member of the Inter-Disciplinary Team, supervised the collection of wildlife data and compilation of the overall document. T. Olson, wildlife biologist

with HWA and B. Parkhurst assisted in the preparation of the document. J. Winstead, K. Jones, T. Olson, L. Bennett, and D. Knowlton, wildlife biologists with HWA, assisted in the collection of field data.

3.0 Current Status and Habitat Use of Species

The FWS has determined that nine species, which are listed under the ESA as either threatened, endangered or proposed, or are candidates for listing under the ESA, are potentially present within the Rawlins BLM Field Office (USDI-FWS 2004a; Table 1). Additionally, ten species that are found downstream of the Rawlins Field Office in the Platte and Colorado River systems may potentially be impacted if water depletions occur. These species and their federal status under the ESA are listed in Table 1.

Table 1. Threatened, endangered, proposed, or candidate species that may potentially be present within the Rawlins BLM Field Office or that may potentially be impacted by the Proposed Action.

Common Name	Scientific Name	Status
Mammals		
Black-footed ferret	*Mustela nigripes*	Endangered
Canada lynx	*Lynx canadensis*	Threatened
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Threatened
Birds		
Bald eagle	*Halieaeetus leucocephalus*	Threatened
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate
Whooping crane*	*Grus americana*	Endangered
Interior least tern*	*Sterna antillarum*	Endangered
Piping plover*	*Charadrius melodus*	Threatened
Eskimo curlew*	*Numenius borealis*	Endangered
Amphibians		
Wyoming toad	*Bufo baxteri*	Endangered
Fish		
Colorado pikeminnow**	*Ptychocheilus lucius*	Endangered
Bonytail**	*Gila elegans*	Endangered
Humpback chub**	*Gila cypha*	Endangered
Razorback sucker**	*Xyrauchen texanus*	Endangered
Pallid sturgeon*	*Scaphirhynchus albus*	Endangered
Plants		

Common Name	Scientific Name	Status
Blowout penstemon	*Penstemon haydenii*	Endangered
Ute-ladies'-tresses	*Spiranthes diluvialis*	Threatened
Colorado butterfly plant	*Gaura neomexicana ssp. coloradensis*	Threatened
Western prairie fringed orchid*	*Platanthera praeclara*	Threatened

* water depletions in the Platte River system may affect these species found downstream of the ARPA.
** water depletions in the Colorado River system may affect these species found downstream of the ARPA.

3.1 Threatened, Endangered, Proposed, and Candidate Species

Black-footed Ferret

The black-footed ferret's original distribution in North America closely corresponded to that of prairie dogs (Hall and Kelson 1959, Fagerstone 1987). In Wyoming, prairie dog (*Cynomys* spp.) colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food and they also use prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980, Fagerstone 1987). Prairie dog towns occurring within the project area were initially located from the air and subsequently mapped from the ground in their entirety. Prairie dog colonies were mapped from an ATV or on foot using a hand-held GPS receiver. Additional studies identified a total of 295 white-tailed prairie dog colonies, comprised of 6,300 acres (2.3% of the area) existing within the ARPA.

On February 2, 2004, the U.S. FWS issued a letter stating that, in Wyoming, surveys for black-footed ferrets are no longer warranted in black-tailed prairie dog complexes and in many white-tailed prairie dog complexes, except for sixteen non-block cleared white-tailed prairie dog complexes (USDI-FWS 2004b). One of these complexes, the Dad Complex is located partially within the ARPA. For the ARPA, a total of 273 white-tailed prairie dog colonies covering 5,720 acres within the Dad Complex and are not included under the block clearance. Therefore, surveys for black-footed ferrets may be warranted prior to ground disturbing activities within these prairie dog colonies. Surveys would be conducted according to U.S. FWS guidelines (USDI-FWS 1989). The remaining white-tailed prairie dog colonies within the ARPA have been block cleared and surveys for black-footed ferrets are no longer warranted. However, these towns located within the block-clearance area should be examined for their potential to provide habitat for relocation of black-footed ferrets.

Canada Lynx

The Canada lynx is one of three major species of wildcats found in North America. Although Wyoming comprises part of the species' historic geographical range, no lynx sightings have been documented in the ARPA or within a six-mile buffer (WGFD 2003). The closest known sighting of a lynx to the ARPA is approximately 55 miles to the east (Reeve et al. 1986 and Beauvais et al. 2001). In a collaborative effort, the BLM and WYNDD completed a lynx habitat suitability map for the State of Wyoming (Beauvais et al. 2001); according to the habitat map, lands within the ARPA provide low to poor quality lynx habitat. Lynx could potentially travel through the ARPA, but the likelihood of this is very low due to a lack of suitable habitat.

Due to the facts that: (1) the project area does not include high elevation lodgepole pine/spruce-fir habitat types preferred by this species, (2) the project area does not support a population of

snowshoe hares (WGFD 2003), (3) there are no recorded lynx sightings within a six-mile buffer in either the WOS (WGFD 2003) or the WYNDD (2003), and (4) the closest potential habitat is approximately 6 miles to the east in the Sierra Madre Mountains, it is unlikely that lynx occur on or near the ARPA and is therefore not discussed further in this document.

Preble's Meadow Jumping Mouse

In Wyoming, Preble's meadow jumping mouse is found within riparian habitat corridors east of the Laramie Range Mountains and south of the North Platte River (USDI-FWS 2004a). Preble's meadow jumping mouse is closely related to the western jumping mouse, and subspecies are generally identified by geographic location (Beauvais 2000). The ARPA is located more than 100 miles west of the known distribution of the Preble's meadow jumping mouse and this species is not expected to occur on the project area and is therefore not discussed further in this document.

Bald Eagle

Bald eagles typically build stick nests in the tops of coniferous or deciduous trees along streams, rivers, or lakes. Selection of nest sites likely depends upon availability of food in the early nesting season (Swenson et al. 1986). Although no bald eagle nests or nesting habitat occurs on the project area, nesting habitat does occur south of the project area along the Little Snake River. Primary wintering areas are typically associated with concentrations of food sources including major rivers that remain unfrozen where fish and waterfowl are available and ungulate winter ranges where carrion is available (Montana Bald Eagle Working Group 1990).

Bald eagles have been observed on the project area primarily during December, January, and February (WGFD 2003). The majority of bald eagle locations on the project area are in the southern portion of the ARPA, close to the Little Snake River. Bald eagles may utilize the project area for foraging during winter months because a large portion consists of winter range for antelope, mule deer, and elk.

The bald eagle winters and nests in proximity to the project area along the Little Snake River. Several ecological factors probably allow for seasonal and/or year-round use by bald eagles along the Little Snake River: (1) some water may remain open on the river year-round providing an adequate supply of fish and waterfowl, (2) the river is adjacent to crucial ungulate winter range, and (3) the riparian zone has many large cottonwood trees for roosting and nesting. This habitat along the Little Snake River is located ½ to 2 miles south of the ARPA. Upland habitat use by bald eagles within the project area would probably be limited to winter scavenging forays. Few trees large enough for eagle roosting or nesting exist on the project area. Inspection of BLM raptor nest records, WGFD WOS records, and results of aerial and ground raptor nest surveys performed by HWA revealed that no bald eagle nests occur within the ARPA.

Yellow-billed Cuckoo

The yellow-billed cuckoo is a neotropical migrant that winters in South America and breeds from southeast Canada, throughout most of the United States (except the northern Great Plains to the northwest coast) and northern Mexico (Payne 1997). In North America, the cuckoo population is divided into two subspecies. The population west of the Continental Divide is considered the Western or California subspecies and the population east of the Continental Divide is the Eastern subspecies. Trends developed from Breeding Bird Survey (BBS) data indicate that the yellow-billed cuckoo is declining throughout its range but the most dramatic declines have been associated with the Western subspecies. As a result, the yellow-billed

cuckoo has twice been petitioned as an endangered species pursuant to the Endangered Species Act (ESA). The Southwest Region of the U.S. Fish and Wildlife Service rejected the first petition submitted in 1987. The second petition was submitted in 1998 and called for the listing of cuckoos west of the Continental Divide as a subspecies or a geographically, morphologically, behaviorally, and ecologically distinct population from cuckoos east of the Continental Divide. In July 2001, the FWS concluded that the petitioned action was warranted but precluded by higher priority listing actions. Currently, the western subspecies of yellow-billed cuckoo (located west of the Continental Divide) is considered a candidate species.

Observations of the yellow-billed cuckoo in Wyoming are very rare, with approximately 24 documented observations since 1982 (Bennett 2002). The yellow-billed cuckoo is a BLM sensitive species throughout all of Wyoming and it may be found in cottonwood/riparian habitats below 7,000 feet and in urban areas throughout the state (WGFD 1999). In Wyoming, it is thought to prefer cottonwood stands for foraging and willow thickets for nesting. The ARPA does not include any large riparian areas with well-developed cottonwood/riparian habitats, therefore it is unlikely that the yellow-billed cuckoo occurs on the project area and it has not been documented on the ARPA (WGFD 2003, WYNDD 2003) and is therefore not discussed further in this document.

Wyoming Toad

The Wyoming toad was historically associated with floodplain ponds along the Big and Little Laramie Rivers in Albany County (Baxter and Stone 1992). Currently, the Wyoming toad is only known to occur at Mortenson Lake National Wildlife Refuge. However, reintroduction efforts are underway in other portions of its former range. The Wyoming toad did not historically, and does not currently occur on or near the ARPA and is therefore not discussed further in this document.

Blowout Penstemon

Blowout penstemon is a member of the Scrophulariaceae (Figwort) family (Fertig 2001) and is probably the rarest plant species native to the Great Plains (Nebraska Game and Parks Commission [NGPC] 2002). The species is most common in the open, sandy habitats of wind-excavated depressions (blowouts) in dune tops. In Wyoming, the species has also been documented on very steep, unstable sand dunes (Fertig 2000). Within these limited habitats, this short-lived perennial frequently occurs in large, multi-stemmed clumps. In June and July, when in bloom in Wyoming, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts. In addition to features of its leaves and flowers, blowout penstemon's lavender or vanilla-like fragrance distinguishes it as only one of two fragrant species of the 300 penstemons in the world (NGPC 2002).

The reproductive life history of the species has led, in part, to the decline of blowout penstemon populations in Wyoming and other native regions. The primary limiting factor in seedling establishment is moisture availability. For blowout penstemon seeds to germinate, and for the roots to reach a depth where moisture is available and constant, blowout sand must remain damp for at least two weeks during the growing season (NGPC 2002). In the arid environment of sandy blowouts, these conditions usually only occur in one out of every eight to ten years (NGPC 2002). Exacerbating the effects of limited germination and establishment conditions is the loss of blowout habitats. Active fire suppression programs and improved range management practices have led to increases in prairie vegetation cover with decreases in sandy areas. The species now remains in only a few locations where wind erosion has maintained sandy blowouts (NGPC 2002).

Blowout penstemon is known to occur in certain habitats south of the Ferris Mountains in the northern part of Carbon County. The plant has the potential to occur on the project area (Fertig 2001, USDI-FWS 2002), especially in the Sand Hills area where a few, active sand dunes are known to exist (Warren 2002). However, the species was not found during field surveys of this area by WYNDD personnel in June 2000 (Fertig 2000).

Ute ladies'-tresses

Ute ladies'-tresses is a perennial, terrestrial orchid with stems 8 to 20 inches tall, and flowers consisting of white or ivory flowers clustered into a spike arrangement at the top of the stem. The plant blooms mainly from late July through August, however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. Habitat for Ute ladies'-tresses can occur in major riparian corridors subject to fluvial erosion/deposition, or more ideally, in moist to very wet meadows along streams. It has also been found in abandoned stream meanders that still have ample ground water, near springs, and lakeshores. The habitat on which the species depends has been drastically modified by urbanization, agriculture, and development (description adapted from NatureServe 2003).

Ute ladies'-tresses was designated as threatened in 1992 when it was only known from Colorado, Utah, and Nevada. Since that time, it has been found in Wyoming, Montana, Nebraska, and Idaho (NatureServe 2003). The known locations of the species in Wyoming include Converse, Goshen, Laramie, and Niobrara Counties. Much of the ARPA is located above the upper known elevation of occurrence (6,800 feet) for this species (Fertig 2002) and the species is not known to occur within the ARPA. However, some areas along the eastern portion of the ARPA may contain marginal habitats for the Ute ladies'-tresses.

Colorado Butterfly Plant

The Colorado butterfly plant is a short-lived perennial herb that typically occurs on sub-irrigated soils on level or slightly sloping floodplains and drainage bottoms at elevations of 5,000-6,400 feet (Fertig 2000). The species is often found a short distance from meandering stream channels. This species is known to occur in Laramie County in southeastern Wyoming, in southwestern Nebraska and in northeastern Colorado. This species is not known and is not expected to occur on or near the ARPA and is therefore not discussed further in this document.

3.2 Colorado River Species

Within the ARPA, a total of approximately 284 miles of intermittent, ephemeral, and perennial streams occur. Perennial surface water is relatively scarce within the ARPA due to limited precipitation (5.8 - 24.3 inches/year). The majority of drainages within the ARPA are ephemeral drainages. Ephemeral waters are those in which the water table is always below the stream channel and only flow in direct response to precipitation or snow melt. Ephemeral waters only support very limited aquatic communities for the short periods when surface flow is present. However, Muddy Creek, its tributaries McKinney Creek and Littlefield Creek, and Savery Creek are perennial streams and are classified as Class 2 and 3 streams by the WDEQ, which support game and non-game species. These streams are considered to be locally to regionally important trout fisheries by the WGFD (1991, 1998).

About 15 reservoirs and ponds (0.5 - 20 acres) are present within the Colorado River Watershed portion of the ARPA. Some of the ponds and reservoirs that currently exist within the ARPA are fed by waters recovered from wells drilled at upstream locations, while others are

impoundments on small drainages. These man-made impoundments are generally designed to supply water for livestock and wildlife use.

Four federally endangered fish species may occur as downstream residents of the Colorado River system: Colorado pikeminnow (*Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) (USDI-FWS 2004a). The Colorado pikeminnow, bonytail, and humpback chub are all members of the minnow family. The razorback sucker is a member of the sucker family. All four of these fish species share similar habitat requirements and historically occupied the same river systems.

The last sighting of any of these fish species in the Little Snake River was of a single Colorado pikeminnow in 1990. Because habitat for these species is not present within the ARPA, these fish species are not likely to be found in tributaries to the Little Snake River within the ARPA, and critical habitat for these species has not been designated in Wyoming (Upper Colorado River Endangered Fish Recovery Program 1999). However, the potential for project-related reductions in water quantity and/or quality to these tributaries to the Colorado River warrant their inclusion in this document.

Colorado Pikeminnow

The Colorado pikeminnow is the largest member of the minnow family and occurs in swift, warm waters of Colorado Basin rivers. The species was once abundant in the main stem of the Colorado River and most of its major tributaries throughout Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada, California, and Mexico. It was known to occur historically in the Green River of Wyoming at least as far north as the City of Green River. In 1990, one adult was collected from the Little Snake River in Carbon County, Wyoming (Baxter and Stone 1995). Subsequent survey attempts to collect Colorado pikeminnow from this area of the Little Snake River by WGFD personnel failed to yield any other specimens.

Bonytail

Habitat of the bonytail is primarily limited to narrow, deep, canyon-bound rivers with swift currents and white water areas (Valdez and Clemmer 1982, Archer et al. 1985, Upper Colorado River Endangered Fish Recovery Program 1999). With no known reproducing populations in the wild today, the bonytail is thought to be the rarest of the endangered fishes in the Colorado River System.

The bonytail historically inhabited portions of the upper and lower Colorado River basins. Today, in the upper Colorado River Basin, only small, disjunct populations of bonytail are thought to exist in the Yampa River in Dinosaur National Monument, in the Green River at Desolation and Gray Canyons, in the Colorado River at the Colorado/Utah border and in Cataract Canyon (Upper Colorado River Endangered Fish Recovery Program 1999).

Humpback Chub

Habitat of the humpback chub is also limited to narrow, deep, canyon-bound rivers with swift currents and white water areas (Valdez and Clemmer 1982, Archer et al. 1985, Upper Colorado River Endangered Fish Recovery Program 1999). The humpback chub was historically found throughout the Colorado River System, and its tributaries, which are used for spawning (Valdez et al. 2000). It is estimated that the humpback chub currently occupies 68% of its original distribution in five independent populations that are thought to be stable (Valdez et al. 2000).

Razorback Sucker

The razorback sucker is an omnivorous bottom feeder and is one of the largest fishes in the sucker family. Adult razorback sucker habitat use varies depending on season and location. This species was once widespread throughout most of the Colorado River Basin from Wyoming to Mexico. Today, in the Colorado River Basin, populations of razorback suckers are only found in the upper Green River in Utah, the lower Yampa River in Colorado and occasionally in the Colorado River near Grand Junction (Upper Colorado River Endangered Fish Recovery Program 1999).

3.3 Platte River Species

A small portion of the ARPA drains into the Platte River system and according to the FWS (USDI-FWS 2004a), water depletions in the Platte River system may contribute to the destruction or adverse modification of designated critical habitat for the following species. None of these species or their habitats are found within the ARPA, but they could be impacted by actions taken on the ARPA.

Whooping Crane

Critical habitat for the whooping crane downstream of the ARPA is located along the Platte River Bottoms between Lexington and Dehman, Nebraska (Federal Register 1978). Whooping crane habitat consists of large expanses of wetlands that provide suitable food (insects, crayfish, frogs, small fish) and open expanses near wetlands for nightly roosting (Federal Register 1978).

Interior Least Tern

The interior least tern nests on un-vegetated sand-pebble beaches and islands of large reservoirs and rivers. Interior least terns avoid areas where relatively thick vegetation provides cover for potential predators. No habitat for the interior least tern is found on the ARPA, but habitat is located downstream of the ARPA along the Platte River in Nebraska (USDI-FWS 1990).

Piping Plover

Critical habitat for the piping plover includes prairie alkali wetlands and surrounding shoreline, including 200 feet of uplands above the high water mark; river channels and associated sandbars, and islands; reservoirs and their sparsely vegetated shorelines, peninsulas, and islands; and inland lakes and their sparsely vegetated shorelines and peninsulas (Federal Register 2002). Critical habitat for the species downstream of the ARPA in Nebraska begins at the Lexington Bridge and extends to the Platte's confluence with the Missouri River 252 mi (405.5 km) downstream (Federal Register 2002). Approximately ¼ of this part of the Platte River is also designated as critical habitat for the whooping crane. Open shorelines and sandbars of rivers, large reservoirs, alkali wetlands, lakes and rivers provide suitable breeding habitat for the piping plover.

Eskimo Curlew

The eskimo curlew migrates from wintering grounds in the pampas of Argentina, northward through Central America and the central Great Plains of North America to breeding grounds in northern Canada and Alaska (Gollop et al. 1986). The spring migration route passes through Nebraska (Gollop et al. 1986), where the birds may stopover along the Platte River. In the fall they migrate eastward to Labrador, then south over the Atlantic Ocean back to South America (Gollop et al. 1986). Habitat for the eskimo curlew includes grasslands, tundra, burned prairies, plowed fields, marshes, mudflats, meadows, and pastures. Burned prairies and marshes may

be attractive during migration (Gollop et al. 1986). The loss of prairie habitat in North America may have contributed to the decline of the eskimo curlew, but the primary reason for the rarity of the bird was market hunting in the late 1800s and early 1900s (Gollop et al. 1986). No suitable habitat for the eskimo curlew occurs on the ARPA and the species has not been reported within or near the ARPA (WGFD 2003, WYNDD 2003).

Pallid Sturgeon

The pallid sturgeon is a native fish found in the Mississippi/Missouri River system. The pallid sturgeon is present in the Platte River, a tributary to the Missouri River, located downstream from a portion of the ARPA. Suitable habitat for the pallid sturgeon consists of large turbid rivers with sand or gravel bottoms. The pallid sturgeon is threatened by habitat degradation such as decreased turbidity, which can be caused by impoundments.

Western Prairie Fringed Orchid

The western prairie fringed orchid is a long-lived perennial herb with stems that can grow to 1.2 m tall from an underground tuber. The plant blooms for about a three-week period starting in mid-June in the southern portion of its range to late July in the north. Habitat of the western prairie fringed orchid is the western portions of the North American tallgrass prairie and it is most commonly observed on moist, calcareous soils, sub-saline prairies and sedge meadows (many flooded for a period of 1-2 weeks during the year). Published accounts and herbarium records suggest that this plant was widespread and perhaps locally common prior to European settlement. Declines are due to the extensive and on-going conversion of the tallgrass prairie to agricultural uses throughout its range (description adapted from NatureServe Explorer 2004).

The western prairie fringed orchid was designated as a threatened species in its entire range in 1989. Within the area covered by this listing, this species is known to occur in Iowa, Kansas, Minnesota, Missouri, North Dakota, Nebraska, Oklahoma, and in Manitoba Province, Canada (NatureServe 2003).

4.0 Direct and Indirect Impacts of the Proposed Project

Although the total acres of wildlife habitat that would be disturbed under the action alternatives over the next twenty years is known, the distribution of this disturbance will not be known until actual site specific well locations and other disturbance activities are determined. Therefore, in order to assess the direct and indirect impacts of the proposed project, it was assumed that any section of land may potentially be developed at the level of 8 locations per section under the Proposed Action and Alternative B. Under Alternative C disturbance levels would be reduced. The extent of disturbance reduction would be determined by the site specific proposals that come forward and the development protection measures that apply.

4.1 Proposed Action

Under the Proposed Action up to 15,800 acres of wildlife habitat would be disturbed by construction activities over the next 20 years. With concurrent reclamation of disturbed habitats the total un-reclaimed disturbance area at any given point in time would never equal the sequential total. Under the Proposed Action, reclamation would reduce impacts to about 6,200 acres or 2.3% of the ARPA by the end of the development phase of the project. Reclamation success will be influenced by timing of reclamation and climatic conditions.

4.1.1 Threatened, Endangered, Proposed, and Candidate Species

Black-footed Ferret

295 white-tailed prairie dog colonies, comprised of 6,300 acres (2.3% of the area) existing within the ARPA. A total of 273 white-tailed prairie dog colonies within the ARPA, covering 5,720 acres, are located within the Dad Complex and are not included under the block clearance. These colonies meet requirements for consideration as black-footed ferret habitat (Biggins et al. 1989). Development of the Proposed Action would likely result in direct disturbance of some portions of these prairie dog colonies.

Surveys for black-footed ferrets may be required prior to ground disturbing activities within prairie dog colonies located in the Dad Complex. Surveys would be conducted according to U.S. FWS guidelines (USDI-FWS 1989). The remaining white-tailed prairie dog colonies within the ARPA are in the “block clearance” area, where surveys for black-footed ferrets are no longer required. However, these towns located within the block-clearance area should be examined for their potential to provide habitat for relocation of black-footed ferrets.

Projects would not be authorized within white-tailed prairie dog colonies within the Dad Complex unless surveys for black-footed ferrets have been completed. If surveys are required, consultation with the FWS will be initiated prior to surveys being conducted. If black-footed ferrets are found, no project related disturbance will occur within the prairie dog complex and all project related activities in such towns or complexes shall be suspended immediately. The FWS will be notified within 24 hours if a black-footed ferret or their sign is observed. Although black-footed ferrets may be affected by this project, as long as the prescribed avoidance and protective measures (listed in the *Conservation Measures* section) are implemented, they are unlikely to be adversely affected.

Bald Eagle

Bald eagles have been observed on the project area primarily during December, January, and February (WGFD 2003). The majority of bald eagle locations on the project area are in the southern portion of the ARPA, close to the Little Snake River. Bald eagles may utilize the project area for foraging during winter months because a large portion consists of winter range for antelope, mule deer, and elk.

Upland habitat use by bald eagles within the project area would probably be limited to winter scavenging forays. Few trees large enough for eagle roosting or nesting exist on the project area. Inspection of BLM raptor nest records, WGFD WOS records, and results of aerial and ground raptor nest surveys performed by HWA revealed that no bald eagle nests occur within the ARPA.

The southern portion of the project area, closest to the Little Snake River, has the highest potential for bald eagle occurrence. This portion of the ARPA contains crucial winter range for elk, mule deer, and pronghorn. The potential for vehicle collisions with big game would increase as a result of increased vehicular traffic associated with the presence of construction crews and activities in the project area. Because bald eagles commonly feed on carrion, particularly during the winter months, the presence of road-killed big game carcasses on and adjacent to the access roads is an attractant. Eagles feeding on these carcasses are in danger of being struck by moving vehicles. Any increase in the death rate of bald eagles from vehicular collisions will constitute a significant impact. Because the potential for an increase in the incidence of big game-vehicle-eagle encounters exists, measures to avoid and/or reduce such incidents will be

taken. Such measures shall include: (1) requirement that regular drivers undergo training describing the circumstances under which vehicular collisions with bald eagles are likely to occur and the measures that can be employed to minimize them, including reduced speeds, (2) prohibition of unnecessary off-site activities of operational personnel and inform all project employees of applicable wildlife laws and penalties associated with unlawful take and harassment, (3) removal of vehicle-killed carcasses from the ROWs of access roads on the project area to eliminate the exposure of carrion-feeding eagles to the threat of being struck by vehicles, and (4) operators will internally enforce existing drug, alcohol, and firearms policies. Given the implementation of these measures, the bald eagle may be affected, but is not likely to be adversely affected.

Blowout Penstemon

Blowout penstemon is known to occur in certain habitats south of the Ferris Mountains in the northern part of Carbon County. The plant has the potential to occur on the project area (Fertig 2001, FWS 2002) only in the Sand Hills area where a few active sand dunes are known to exist (Warren 2002). However, the species was not found during field surveys of this area by WYNDD personnel in June 2000 (Fertig 2000). Given the presence of potential habitat within the ARPA, implementation of the action alternatives may directly impact some individual plants of this species. Should this species be found within the ARPA, the specific sites where it is found would be avoided to prevent any potential impacts.

Ute Ladies'-tresses

The known locations of Ute ladies'-tresses in Wyoming include Converse, Goshen, Laramie, and Niobrara Counties. Potentially suitable habitats for this species are very limited within the ARPA. This species is not known to occur within the ARPA and the likelihood of it occurring in the ARPA is low due to the following reasons: (1) much of the ARPA is very arid and there are few perennial streams, (2) the elevation of the project area is near the upper limit for the species, (3) very few moist riparian area meadows are present, (4) the transition from stream margins to upland vegetation is abrupt, and (5) the species has only been located in eastern and southeastern Wyoming (Fertig 2002). Given the presence of potential habitat within the ARPA, there is a slight chance of impacts due to the low likelihood of it occurring. If this species is found within the ARPA in the future, the specific sites where it is found would be avoided to prevent any potential impacts.

4.1.2 Colorado River Species

Four federally endangered fish species may occur as downstream residents of the Colorado River system: Colorado pikeminnow, bonytail, humpback chub, and razorback sucker (USDI-FWS 2004a). All four of these fish species share similar habitat requirements and historically occupied the same river systems. Declines in populations of these species are mainly attributed to impacts of water development (e.g. dams and reservoirs) on natural temperature and flow regimes, creation of migration barriers, habitat fragmentation, the introduction of competitive and predatory non-native fishes, and the loss of inundated bottom lands and backwater areas (Minckley and Deacon 1991, USDI-FWS 1993).

Under the action alternatives, no produced water will be discharged to the Colorado River system; therefore, produced water discharges do not pose a risk to these species. Implementation of all appropriate mitigation measures for water resources and soils identified in the ARPA would prevent potential downstream sedimentation and/or contamination caused by

construction activities. Therefore, water quality in the Colorado River system is not expected to be impacted under any of the action alternatives.

Limited water depletions within the Colorado River system are expected from drilling activities within the ARPA. Water depletion from the Colorado River system as a result of road/pad construction and dust abatement would be approximately 10.3 acre-feet per year for the entire project area, and a mitigation fee would not be applicable. Water depletions to the Colorado River system as a result of this project may adversely affect these four fish species. This determination is based on the Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin which was initiated on January 22, 1988. The Recovery program was intended to be the reasonable and prudent alternative to avoid jeopardy to the endangered fish by depletions from the Upper Colorado River. A part of the Recovery Program was the requirement that if a project was going to result in a depletion, a depletion fee would be paid to help support the Recovery Program. On July 5, 1994, the Service issued a biological opinion determining that the fee for depletions of 100 acre-feet or less would no longer be required. This was based on the premise that the Recovery Program has made sufficient progress to be considered the reasonable and prudent alternative avoiding the likelihood of jeopardy to the endangered fishes and avoiding destruction or adverse modification of their critical habitat by depletions of 100 acre-feet or less.

4.1.3 Platte River Species

The whooping crane, interior least tern, piping plover, Eskimo curlew, pallid sturgeon, and western prairie fringed orchid are all found downstream of the ARPA along the Platte River. No habitat for any of these species occurs on the ARPA and they are not likely to occur there. Under any of the action alternatives, no produced water will be discharged to the Platte River system; therefore, produced water discharges do not pose a risk to these species. Implementation of all appropriate mitigation measures for water resources and soils identified in the ARPA would prevent potential downstream sedimentation and/or contamination caused by construction activities. Therefore, water quality in the Platte River system is not expected to be impacted under any of the action alternatives. No water depletion from the Platte River system will occur as a result of the proposed project.

4.2 Alternative A – No Action

Under Alternative A no wildlife habitat would be disturbed.

4.3 Alternative B – Sequential Alternative

Under this alternative construction activities would be focused into one of three discrete areas at any one time. This would localize and intensify wildlife and habitat disturbance within the area of construction activities, but would minimize disturbance throughout the remaining project area. Disturbance associated with operational activities would gradually increase throughout the ARPA as the project progresses and would be ultimately similar in effect to the Proposed Action when construction activities are completed.

4.4 Alternative C – Spatial

Development for natural gas would occur as in the proposed action, but would be conditioned with the application of required development protection measures in those areas with sensitive

or crucial resource values. These types of areas are unique enough to require additional protective measures beyond what is already provided by applying the standard Best Management Practices (BMPs) (Appendices H and I), lease stipulations, and Conditions of Approval (COAs). With a focus on surface disturbance limits, limited operating periods, modification of drilling and construction practices, and, in some cases, no surface occupancy surface disturbance extents would be limited to about 50 % of the Proposed Action and Alternative B. Resource data, in the form of GIS layers, would be used to identify specific areas of resource concern. Geographic information system (GIS) layers would be available to operators for their development of the annual program of work, and to the BLM in assessing and approving those proposals while reducing adverse impacts to those sensitive and / or crucial resource values.

5.0 Cumulative Impacts

The cumulative impact analysis (CIA) approach is used to evaluate the influences of recent, past, present, and reasonably foreseeable future human developments on the local wildlife resources. This approach examines impacts associated with a proposed project in context with all other past and future developments, whether or not they are related. It also allows the wildlife manager and land management agency to evaluate impacts on a broader scale. The BLM recommends evaluating cumulative impacts on a watershed basis for natural resources related to watershed function and stability.

Existing disturbance within the ARPA is approximately 763 acres, or around 0.28 percent of the 270,000 acres comprising the project area. During the construction phase, the Proposed Action and Alternative B would disturb up to 15,800 acres or 5.9 % of the overall project area. Alternative A (no action) would not disturb any acreage. Alternative C is estimated to disturb approximately half that of the Proposed Action or 7,900 acres for 2.9 % of the overall project area. Disturbance areas within the ARPA would be reduced upon reclamation of pipeline ROWs, unused portions of the drill pad, portions of roads, and ancillary facility disturbances during the production phase for each alternative, resulting in long-term disturbance of about 6,200 acres under the Proposed Action and Alternative B, 3,100 acres under Alternative C, and no acreage under Alternative A.

Black-footed Ferret

Provided that avoidance measures outlined in this document are followed, the potential for an incremental increase in cumulative impacts due to the implementation of the Proposed Action or Alternatives B or C may affect the black-footed ferret but is not likely to adversely affect the black-footed ferret.

Bald Eagle

Bald eagles are not known to nest on the ARPA, but may use portions of the project area, especially during winter months when carrion is available. Provided that avoidance measures outlined in this document are followed, the potential for an incremental increase in cumulative impacts due to the implementation of the action alternatives (Proposed Action, B, C) or Alternative A (No Action) may affect but is not likely to adversely affect the bald eagle.

Blowout Penstemon

Implementation of the any of the alternatives is not expected to contribute cumulative impacts upon blowout penstemon due to a lack of confirmed occurrences of the species within the

ARPA. Should surveys identify populations of blowout penstemon, such populations and associated habitats would be avoided.

Ute Ladies'-tresses

Implementation of the any of the alternatives is not expected to contribute to cumulative impacts upon Ute ladies-tresses due to a lack of confirmed occurrences of the species within the ARPA. Should surveys identify populations of blowout penstemon, such populations and associated habitats would be avoided.

Colorado River Species

On July 5, 1994, the Service issued a biological opinion determining that the fee for depletions of 100 acre-feet or less would no longer be required. This was based on the premise that the Recovery Program has made sufficient progress to be considered the reasonable and prudent alternative avoiding the likelihood of jeopardy to the endangered fishes and avoiding destruction or adverse modification of their critical habitat by depletions of 100 acre-feet or less. Cumulative impacts to the endangered fish species that are downstream of the ARPA in the Colorado River are expected to be less than 100 acre-feet per year from the project, under any of the alternatives.

Platte River Species

These species do not occur on the ARPA and no water depletions to the Platte River system are expected, therefore implementation any of the alternatives would not contribute to cumulative impacts upon these species.

6.0 Conservation Measures to Avoid or Reduce Adverse Impacts

The following procedures will be implemented to eliminate or substantially reduce potential adverse effects of the proposed project to threatened, endangered, proposed, candidate, and petitioned species that may occur on or near the ARPA or that may be impacted by the project.

- If disturbance of prairie dog colonies located within the Dad Complex can not be avoided, black-footed ferret surveys will be conducted according to FWS guidelines (USDI-FWS 1989) if the affected towns meet the survey requirements.

- Well pads and disturbances shall be placed outside of (50 m) prairie dog colonies where feasible. In the non-block cleared areas of the ARPA, any construction would require block surveys for the presence of black-footed ferrets. In those area that are block cleared, disturbance is minimized to limit disturbance to as few a burrows as possible.

- Should black-footed ferrets be documented in a prairie dog complex located within the project area, impacts to the species or its habitat will be suspended immediately.

- The operators shall conduct educational outreach to employees regarding the nature, hosts, and symptoms of canine distemper, and its effects on black-footed ferrets, focusing attention on why pets should be prohibited from work sites.

- All suspected observations of black-footed ferrets, their sign, or carcasses on the ARPA, however obtained, shall be promptly (within 24 hours) reported to the BLM and FWS.

- All drivers shall undergo a training session describing the type of wildlife in the area that are susceptible to vehicular collisions in order to reduce the potential for vehicle-big game collisions and subsequent jeopardy to bald eagles feeding on road-killed carrion. The circumstances under which such collisions are likely to occur, and the measures that could be employed to minimize them shall be discussed. Reduced speed limits shall be implemented to reduce potential for vehicle-wildlife collisions.

- Carcasses shall be removed from access roads, shoulders, and the ROWs to minimize bald eagle exposure to vehicles.

- Remote monitoring of project facilities would be utilized to the extent possible to reduce human activity levels within the gas field during the production phase.

- All appropriate sedimentation, erosion control, and produced water control measures included in the Record of Decision will be implemented to avoid changes in water quality or quantity in the streams within the ARPA.

- Construction equipment fueling and servicing areas shall be located at least 150 feet from surface water drainages and riparian areas and away from slopes that drain into those areas.

- High construction standards and rigid safety precautions that adhere to approved design criteria to minimize the potential for an accidental spill or discharge of any chemical or petroleum product into surrounding watershed systems shall be implemented.

- As a safety measure, buffer zones of undisturbed vegetation along water courses shall be maintained to inhibit transport of potentially contaminated runoff to surface waters.

7.0 Effects of the Project on the Expected Status of Species in the Future

Provided that the conservation measures described above are implemented, the proposed action and alternatives are not expected to alter the current status of, or result in any decreased survival of, any of the species discussed in this document during the project or after project completion.

8.0 Determination of Effects for Listed Species

Black-footed Ferret

Based upon the analyses of the alternatives, the current and potential status of the species in the project area, other land use activities in the area, and incorporation of the conservation measures recommended in this BA, it is concluded that implementation of the alternatives **may affect** but is **not likely to adversely affect** the black-footed ferret.

Canada Lynx

Based on the lack of suitable habitat in the project area it is unlikely that lynx would occur on the ARPA. Therefore, the alternatives would have **no effect** on the Canada lynx.

Preble's Meadow Jumping Mouse

Based upon the known distribution of the Preble's meadow jumping mouse it is extremely unlikely that they would occur on the ARPA. Therefore, the alternatives would have **no effect** on the Preble's meadow jumping mouse.

Bald Eagle

Based upon the analyses of the alternatives, the current and potential status of the species in the project area, other land use activities in the area, and incorporation of the conservation measures recommended in this BA, it is concluded that implementation of the alternatives **may affect** but is **not likely to adversely affect** the bald eagle.

Wyoming Toad

Based upon the known and historic distribution of the Wyoming toad it is extremely unlikely that they would occur on the ARPA. Therefore, the alternatives would have **no effect** on the Wyoming toad.

Blowout Penstemon

Based upon the analyses of the alternatives, the current status of these species, other land use activities in the area, and incorporation of the conservation measures recommended in this BA, it is concluded that implementation of the alternatives **may affect** but is **not likely to adversely affect** blowout penstemon.

Ute ladies'-tresses

Based upon the analyses of the alternatives, the current status of these species, other land use activities in the area, and incorporation of the conservation measures recommended in this BA, it is concluded that implementation of the alternatives **may affect**, but is **not likely to adversely affect** Ute ladies'-tresses.

Colorado Butterfly Plant

Based upon the known distribution of the Colorado butterfly plant it is extremely unlikely that they would occur on the ARPA. Therefore, the alternatives would have **no effect** upon the Colorado butterfly plant.

Colorado River Species

On July 5, 1994, the Service issued a biological opinion determining that the fee for depletions of 100 acre-feet or less would no longer be required. This was based on the premise that the Recovery Program has made sufficient progress to be considered the reasonable and prudent alternative avoiding the likelihood of jeopardy to the endangered fishes and avoiding destruction or adverse modification of their critical habitat by depletions of 100 acre-feet or less. Impacts to the endangered fish species that are downstream of the ARPA in the Colorado River are expected to be less than 100 acre-feet per year, under any of the alternatives.

The Colorado pikeminnow, bonytail, humpback chub, and razorback sucker do not occur on the ARPA and the minimal water depletions to the Colorado River system that may occur would impact these species. Therefore, it is concluded that implementation of the action alternatives is **likely to adversely affect** these fish species.

Platte River Species

The whooping crane, interior least tern, piping plover, Eskimo curlew, pallid sturgeon, and western prairie fringed orchid do not occur on the ARPA and no water depletions to the Platte River system would occur. Therefore, it is concluded that implementation of the Proposed Action and any of the alternatives would have **no effect** upon these species.

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APPENDIX H

BEST MANAGEMENT PRACTICES

Required Best Management Practices
Consolidated Table
Appendix H

These BMPs will be applied under all alternatives as Conditions of Approval where projects conflict with identified resources.

Additional site-specific Conditions of Approval may be implemented at the project level as applicable.

Additional mitigation measures are also identified in:

- Appendix K, Applicant Voluntary Committed Measures
- Appendix B, Reclamation Plan,
- Appendix E, Wildlife Monitoring/Protection Plan
- Appendix J, Best Management Practices for Reducing Non-Point Source Pollution

These mitigation measures are further described in:

- Draft Rawlins Resource Management Plan
- BLM/Forest Service *Surface Operating Standards for Oil & Gas Exploration and Development* ("Gold Book")
- BLM Manual 9113

Paleontology Resources		
Paleontology Resources	Each proposed facility located in areas with known and potential vertebrate paleontological resource significance (Class II Paleontology Condition 1 and 2 areas and Probable Fossil Yield Class 3, 4, and 5 areas) would be surveyed by BLM-approved paleontologist prior to surface disturbance (USDI-BLM 1987b;1990) 2) If paleontological resources are discovered at any time during construction, all construction activities would halt and BLM personnel would be immediately notified. Work would not proceed until paleontological materials are properly evaluated by a qualified paleontologist.	
Cultural Resources		
Cultural sites eligible under criterion D - Physical Site Locations Sites containing or likely to yield important scientific data; Sites associated with Important people or events, unique construction (see Appendix X)	1) Collocate roads and pipelines 2) Data recovery	Wyoming State Protocol - Approved procedures for the implementation of Section 106 NHPA and 36 CFR 800 Criteria for Eligibility are found in 36 CFR 60.4
Cultural sites eligible under criterion A, B, and C, including Historic Trails Visual Setting	1) Collocate roads and pipelines 2) Brush hog all rights-of-way where feasible. 3) No surface disturbance within ¼ mile of the trails or visual horizon whichever is closer. 4) Use low-profile facilities. 5) Paint all surface facilities a color compatible with local environment. 6) Surface all roads with material compatible in color with the local environment.	Wyoming State Protocol - Approved procedures for the implementation of Section 106 NHPA and 36 CFR 800 Criteria for Eligibility are found in 36 CFR 60.4; Special measures should be considered within 2 miles either side of the entire trail corridor, since viewsheds of contributing segments may be affected even if a project is located immediately adjacent to a non-contributing portion.

Native American Sensitive Sites/Traditional Cultural Properties (TCP) Native American Consultation is the first step to identify important mitigation measures to be considered	Determined on a case-by-case basis	Numerous laws and directives including: Native American Graves Protection and Repatriation Act of 1990 (NAGPRA); American Indian Religious Freedom Act of 1978 (AIRFA); Executive Order 13007 Native American sensitive sites may or may not be eligible for the National Register. Mitigation measures are considered on a site specific basis.
Fluid Minerals		
SMAs water resources, visual resources, wildlife, vegetation, fisheries	1) Require transportation planning map in a GIS compatible format with all operator coordination and input, to minimize duplication of roads, compressor stations, pipelines and other facilities.	
Reducing Impacts from fluid mineral construction, operation, and reclamation	1) Directional drilling 2) Drill multiple wells from a single pad 3) Transportation planning (to reduce road density and traffic volumes) 4) Remote well monitoring 5) Pipe produced liquids to centralized tank batteries off-site to reduce traffic to individual wells 6) Submersible pumps 7) Below ground well heads 8) Bus workers to reduce traffic volume 9) Flareless well completions 10) Bury distribution power lines and flowlines in or adjacent to access roads. 11) Design and construction of all new roads to a safe and appropriate standard, “no higher than necessary,” to accommodate their intended use 12) Reuse of old roads or pads 13) Interim reclamation of well locations and access roads soon after well is put into production, as described in the Reclamation Plan, Appendix B. 14) Avoid facility placement on steep slopes, ridge tops, and hill tops. 15) All production facilities installed on location that have the potential to leak or spill oil, glycol, produced water, or other fluid, shall be placed within an appropriate containment or diversionary structure.	BMPs; Reclamation Plan – Appendix B

	16) On-site bio-remediation of oil field wastes and spills 17) Remove trash, junk, waste and other materials not in current use. 18) All existing and proposed roads shall be brought up to BLM minimum standards as found in BLM Manual 9113.	
Reclamation Plan		
Appendix B – Reclamation Plan Control and minimize surface run-off, erosion, and sedimentation; invasive weed control; native vegetation and habitat protection/restoration; visual resource management	See Appendix B – Reclamation Plan for complete, specific reclamation guidance	
Vegetation Resources		
Aspen, Juniper Woodland, Serviceberry, Mountain Mahogany vegetation communities.	1) Avoidance areas. Plans should be submitted and approved by BLM for surface disturbance in these areas. Only those areas that cannot be avoided could be approved.	Plant communities which failed to meet Rangeland Health Standard #3 in 2001 assessment. These communities are high value, low occurrence, and present reclamation difficulties
Control of invasive weeds	Weeds shall be controlled on project disturbed areas and native areas infested as a direct result of the project. The control methods shall be in accordance with guidelines established by the EPA, BLM, state and local authorities. Prior to the use of pesticides, the operator will obtain written approval from the BLM Authorized Officer (meaning an approved pesticide use proposal form).	Wyoming Weed and Pest Control Act, 1973 & Wyoming Weed and Pest Special Management Program, Title 11, Chapter 5. Executive Order 13112
Protection of study areas.	Avoid any disturbance to monitoring sites.	Rangeland Health Standards, 43CFR 4180.1

Visual Resource Management		
VRM Management Class III areas visible from State, County and BLM roads in Viewshed	1) Gravel of road surfacing shall be similar color to adjacent dominant soil colors. 2) Avoid locating pads in areas visible from primary roads. 3) Avoid locating facilities on or near ridgelines - use subsurface or low-profile facilities to prevent protrusion above horizon line when viewed from any primary road. 4) Avoid routing well access roads directly from State, County, or BLM roads. 5) Co-locate wells when possible. 6) Locate facilities far enough from the cut and fill slopes to facilitate recontouring for interim reclamation. 7) Do not locate wells adjacent to prominent features such as rock outcrops. 8) Repeat elements of form, line, color, and texture to blend facilities and access roads with the surrounding landscape 9) Complete annual transportation plan for entire area before beginning construction - make layout that will minimize disturbance and visual impact. 10) Design and construct all new roads to a safe and appropriate standard, “no higher than necessary” to accommodate their intended use. 11) Locate roads far enough off the back of ridgelines so they aren't visible from State, County or BLM roads. 12) Use remote monitoring to reduce traffic and road requirements. 13) Remove unused equipment, trash and junk immediately. 14) Reclaim unnecessary access roads as soon as possible. 15) All above-ground structures, production equipment, tanks, transformers, insulators, not subject to safety requirements shall be painted to blend with the natural color of the landscape. The paint used shall be a non-reflective “Standard Environmental Color” approved by the BLM VRM specialist.	VRM BMPs for Fluid Minerals, VRM H-8400-1, Land Use Planning H-1601-1
Slopes < 5% in VRM Management Class III areas visible from State, county and BLM roads Minimizing road construction methods will reduce visual impacts by reducing vegetative removal and soil exposure.	1) Do not create unnecessary cut and fill. Design and construct all new roads to a safe and appropriate standard, “no higher than necessary” to accommodate their intended use.	VRM BMPs for Fluid Minerals, VRM H-8400-1, Land Use Planning H-1601-1

Water and Soil Management		
Non-Point Source Pollution	See Appendix J, Best Management Practices for Non-Point Source Pollution	Clean Water Act Section 303(e) and 40 CFR 130.5
Water Management Plan as part of the Annual Work Plan submittal in April	1) The Atlantic Rim operator responsible for new development around existing pods will submit a Water Management Plan as part of the Annual Workplan submittal in April. This plan will have the following information: o 12-digit HUC number and name o All digital and other information required by the Annual Workplan o Surface water assessment of current road network in the area including future plans for maintenance. o Average daily water production per well at current pod wells. o Average daily injection volumes of current injection wells, by well. o Unused injection well capacity o Estimated water production from proposed wells o Location, name and estimated capacity of new injection wells o Special Protection Measure for each well location, if appliciable o Any water quality sampling results	Monitoring, planning and compliance for the success of the project
Surface disturbance on slopes >25% as identified from the 30 meter DEM data.	1) Plans should be submitted and approved by BLM for surface disturbance in these areas. Only those areas that cannot be avoided could be approved.	Wyoming Standard Mitigation Guidelines
Drainage Crossings	1) Culverts or low-water crossings would be installed for all ephemeral and intermittent drainage crossings. All drainage crossing structures and culverts would be designed to pass at a minimum the 25-year discharge events, or as otherwise directed by the BLM. 2) The design of channel crossings will minimize changes in channel geometry and subsequent changes in flow hydraulics. Disturbed channel beds will be regarded to the original geometric configuration with the same or very similar bed material. 3) Construction of drainage crossings will be limited to no-flow periods or low-flow periods. 4) Channel crossings for buried pipelines will be constructed such that the pipe is buried a minimum of four feet below the channel bottom.	Wyoming Standard Mitigation Guidelines
Reducing surface runoff and erosion	1) Adequate drainage control devices and measures would be included in the road design and maintenance (e.g., road berms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipaters) at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road environment to avoid concentrated flows. 2) Locations for these features will be proposed in Annual APD approval	Wyoming Standard Mitigation Guidelines

	master plans submitted by the operator and will be identified specifically in construction plans after BLM onsites. 3) Erosion control devices would also be used in conjunction with the surface runoff and drainage control devices, such as temporary barriers, ditch blocks, erosion stops, mattes, mulches, and vegetative covers. A revegetation program would be implemented as soon as possible to re-establish the soil protection afforded by a vegetal cover.	
Well Inventories Water developments associated with groundwater	1) All potentially affected landowners having properly permitted water wells with the Wyoming State Engineer's Office within each proposed well's circle of influence (1/2 mile radius) were offered a Water Well Agreement; and if a water well agreement is not reached with the landowner, the responsible Atlantic Rim Operator will mitigate the impacts in accordance with State of Wyoming water laws. Some examples of mitigation would be drilling an additional supply well or provide CBNG water as an offset.	Potential Impact Mitigation – Note that this is situation is very unlikely to occur, but important to address if it does occur.
Interim reclamation of unused areas.	1) The Operators propose to completely reclaim all disturbed areas not needed for production activities including 1) pipeline ROW, 2) portion of road ROW not needed in the function of the road, and 3) the portion of the drill pad not needed during production. Reclamation would generally include 1) complete cleanup of the disturbed areas; 2) the topography would be restored to contours that existed prior to construction; 3) ripping of disturbed areas to a depth of 12 to 18 inches; 4) topsoil or suitable plant growth material would be replaced over all disturbed surfaces; and 5) seeding of reclaimed areas with the seed mixture prescribed in the Surface Use Plan or Plan of Development for the proposed Action, and 6) mulching or soil amendments, if considered necessary by the BLM officer.	Reduce long-term disturbance by improving reclamation success.
Water Used for Construction, Maintenance, and Drilling Activities	1) All water used for drilling, completion and testing activities will come from existing CBNG wells or re-used from other drilling sites, subject to State permitting. 2) All water used for construction, dust abatement or hydrostatic testing will come from existing CBNG wells or sources with sufficient quantities and through appropriation permits approved by the State of Wyoming. Surface water and shallow groundwater sources would only be located in the Colorado River Basin and has been consulted on with the Fish and Wildlife Service (See Appendix x: Biological Opinion). Under no circumstances are these methods to be used for water disposal, only volumes appropriate for the use would be approved. 3) Hydrostatic test water will be discharged in a controlled manner onto an energy dissipater and within existing ROWs. The water is to be discharged onto undisturbed land that has vegetative cover and with energy dissipation such as using a rock armored apron or gated pipe. Prior to discharge, water	CBNG water is generally of good enough water quality in this area to be used for these purposes. Waters from the producing coal seams has been shown to be geographically isolated from most water sources (see 4.4). These are proper beneficial uses with the States approval that would not change impacts if used in volumes commiserate with the water needs. These methods are not intended to help with

	should be tested and treated or filtered if necessary to reduce pollutant levels or to settle out suspended particles if necessary. Coordinate all discharge to test water with the SEO, WDEQ and the BLM.	water disposal needs for the project, since they are generally of such low volumes
	Range Management	
Range Improvements	1) Employ prevention measures to avoid damaging fences, gates, and cattleguards. 2) Report and correct any damage that occurs to rangeland improvement projects. 3) Prior to drilling, upgrade cattleguards and gates width and load bearing requirements to meet BLM Road Standards (BLM Manual 9113).	Protect function and value of range improvements
Reduce danger to livestock from potential hazardous wastes	1) For the protection of livestock, all pits and open cellars shall be fenced. Fencing shall be in accordance with BLM specifications.	
	Wildlife	
Appendix F Wildlife Monitoring/Protection Plan Wildlife Monitoring/Protection	For complete list of wildlife protection measures, see Appendix E	
Big Game crucial winter range	1) Directional drilling 2) Drill multiple wells from a single pad 3) Remote well monitoring 4) Transportation planning (to reduce road density and traffic volumes) 5) Cluster development 6) Compensation mitigation 7) Seasonal restriction of public vehicular access.	BMP's
Greater sage-grouse and Columbian sharp-tailed grouse habitat	1) Directional drilling 2) Drilling of multiple wells from a single pad 3) Seasonal restriction of public vehicular access 4) Noise reduction techniques and designs 5) Use of low profile well facilities and tanks 6) Burying of power lines to avoid use of poles and other tall structures 7) Transportation planning to align roads out of sight and sound of leks, and to schedule traffic to avoid greater sage-grouse and Columbian sharp-tailed grouse activity periods 8) Design of roads to minimum safe standard for intended use 9) Partial reclamation of resource roads needed for project construction to lower standards necessary for maintenance operations	BMP's

Wildlife Habitat	1) Seasonal restriction of public vehicular access 2) Implementation of the Wyoming Bird Conservation Plan from Wyoming Partners in Flight.	BMP's
Potential hazards to wildlife	1) For the protection of wildlife, all pits and open cellars shall be fenced. Fencing shall be in accordance with BLM specifications. Netting shall be placed over all open production pits to eliminate any hazard to migratory birds or other wildlife. Netting is also required over reserve pits which have been identified as containing oil or hazardous substances (CERCLA Section 101(14)) as determined by visual observation or testing. The mesh diameter shall be no larger than one inch. 2) Cover vent pipes to prevent bats or small birds from being trapped.	
Atlantic Rim mule deer study, Game & Fish Data Disruption of mule deer migration corridors.	1) NSO narrow migration corridor (to be determined following data collection and analysis from Mule Deer Study). 2) Avoid surface disturbance within identified migration corridors.	Minimum programmatic standards recommended by the Wyoming Game and Fish Department to sustain wildlife habitats affected by oil and gas development (WGFD 2004)
Reduce incidental loss of wildlife	1) Inform all project employees of applicable wildlife laws and penalties associated with unlawful take and harassment. 2) Require that regular drivers undergo training describing the types of wildlife in the area that are susceptible to vehicular collisions, the circumstances under which such collisions are likely to occur, and the measures that can be employed to minimize them.	

APPENDIX I

CULTURAL RESOURCES MANAGEMENT

Program Objectives

The BLM has developed a cultural resources program designed to inventory, evaluate, and manage cultural resources on BLM-administered public land and in areas of BLM responsibility. The BLM management of cultural resources (archaeological, historic, and socio-cultural properties) is in accordance with the provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, and other applicable legislation.

Identification of Cultural Resources

The BLM requires cultural resource inventories for actions involving public lands and/or federal mineral estate that include surface disturbance as a part of the action. Three classes of inventory have been established; Class III is the most intensive and the most often required for areas that have not been subjected to previous inventories or have been subjected to complete surface disturbance in the past.

Class I inventories are completed with the use of existing data from cultural resource inventory files maintained by both the BLM and the Wyoming State Historic Preservation Office (SHPO). Class I inventories serve to identify known properties and are used to determine if more intensive inventory of specific areas is appropriate. This determination is made in consultation with the Wyoming SHPO and often results in the completion of Class II or Class III inventories.

Class II inventories are statistically based sample surveys designed to aid in characterizing the probable density, diversity, and distribution of cultural properties in the area, to develop and test predictive models, and to answer appropriate research questions. Within individual sample units, survey aims, methods, and intensity are the same as those applied in Class III survey. Class II survey may be conducted in several phases, using different sample designs, to improve statistical reliability.

Class III intensive field surveys are conducted by professional archaeologists thorough pedestrian survey of an entire target area. The intent of a Class III inventory is to locate and record all historic properties and is consistent with standards in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716). Class III inventories conform to the prevailing professional survey standards for the region involved, provided that the regional standards meet or exceed the Secretary's Standards and Guidelines. Because Class III survey is designed to produce a total inventory of the cultural properties observable within the target area, once it has been completed no further survey work should be needed in the target area as long as the current standards are met. Areas with a high probability of containing buried cultural materials or known cultural materials may require additional work of professional monitoring and/or data recovery excavations. Areas that require additional work are analyzed on a case-by-case basis, depending on the proposed action and the types of cultural resources present in the project area.

Evaluation of Cultural Resource Sites

The BLM evaluates the significance of cultural resources identified during inventory in consultation with the Wyoming SHPO to determine if the resources are eligible for inclusion in the National Register of Historic Places (NRHP). Cultural resource properties may be

considered eligible for listing on the National Register if they meet one or more of the following criteria:

- Criterion A: An historic property is associated with an event or events that have made a significant contribution to the broad patterns of America's History.
- Criterion B: An historic property is associated with the lives of persons significant to our past.
- Criterion C: An historic property embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic value or represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: An historic property has yielded or may be likely to yield information important in prehistory or history.

Those sites eligible under Criteria A, B, or C require case-by-case consultation in which the Wyoming SHPO has 30 days to reply. According to a Programmatic Agreement between the Wyoming BLM and the Wyoming SHPO, the BLM has implied concurrence for determining eligibility of sites under Criterion D of the NHPA.

- To facilitate evaluation of cultural resource values in Wyoming, the BLM has devised guidelines for determining the eligibility of archaeological and historical sites and historic trails (BLM Manual 8110.32). The guidelines supplement the National Register criteria for evaluation (36 CFR 60.4) and provide consistency across the state. Application of the guidelines ensures that significant cultural resources are recognized and managed accordingly.

Properties that encompass large areas can be deemed to have contributing and non-contributing portions. Contributing portions are seen to retain integrity of the values for which the property is considered eligible for the NRHP. Non-contributing portions are identified portions of the property which are not deemed to retain the integrity of values which would render the property eligible for the NRHP. The determination of contributing versus non-contributing portions of an eligible property can be made at any time after adequate evaluation has been conducted.

The historic Cherokee Trail is considered eligible for the National Register under Criterion A. However, some portions of the trails no longer retain the aspects of integrity necessary for eligibility. As there have been no encompassing inventories of the entire trail within the RMPPA, portions of the trail are evaluated to determine if they contribute to the eligibility of the property on a case-by-case basis. Trail segments are evaluated pursuant to the National Register criteria of integrity (location, design, setting, materials, workmanship, feeling, and association). If a predominance of criteria are met, the segment will be considered contributing to the properties' overall NRHP eligibility.

STANDARD PROTECTIVE MEASURES

Description

Within the framework described above, the BLM has developed protective measures to minimize adverse effects on significant cultural resource values.

Protective measures are used in response to the actions of BLM programs involving surface disturbance. These measures include cultural resource inventories, evaluation of cultural resources located during inventory, and mitigation of potential adverse impacts on significant cultural resources. Mitigation may include avoidance, data recovery (including excavation), or other protective measures. Avoidance is the primary and preferred mitigative measure used to protect cultural resources. Consultation with the Wyoming SHPO and the Advisory Council on Historic Preservation is required when surface-disturbing actions are expected to adversely affect properties eligible for the National Register. An adverse effect to an historic property is defined in 36 CFR 800.5(1)..

Although Class III inventories are completed before any surface disturbance can begin, the BLM's opportunity to preserve significant cultural resource values in place can be precluded if cultural properties are not identified prior to initiation of an action. In cases such as this, mitigative actions such as data recovery would be implemented.

For historic trails such as the Cherokee Trail, protection measures would be carried out similarly to other historic properties if any project were found to be located within ¼ mile of a contributing portion of the historic trail. When a proposed project is outside of the ¼ mile buffer of the trail, but found to be within the two-mile viewshed that contributes to NRHP eligibility, analyses of potential impacts to the trails are conducted through viewshed analyses, on-site inspection, and photo inspection. Mitigation measures used to ensure that the contributing viewshed of historic trails are not adversely affected include decreasing the height of well tanks, using paint and topography to blend well locations into the background, mowing and reseeding pipeline corridors, and using materials that match the existing environment to construct access roads.

APPENDIX J

BEST MANAGEMENT PRACTICES FOR REDUCING NON-POINT SOURCE POLLUTION

This appendix describes bested management practices utilized to mitigate adverse effects caused by surface disturbing activities that can contribute to non-point pollution. It should be noted, there are multiple volumes of references for BMPs developed by government and nongovernmental agencies to reduce non-point sources of pollution. Many of these documents contain specific practices and design criteria, the State of Wyoming DEQ publishes general BMPs for Wyoming, (http://deq.state.wy.us/wqd/watershed.asp#non).

Best Management Practices (BMPs) have been developed through experience working with disturbances in the Rawlins Field Office from BLM approved actions and should be used in most cases along with Wyoming BLM Standard Mitigation Guidelines for Surface-Disturbing and Disruptive Activities (Appendix 1). These practices are not stipulations but represent practices that in most cases will serve to improve the design and reduce the environmental impact of proposed BLM management actions in the RMPPA. Operators are encouraged to review these practices, incorporate them where appropriate, and where possible develop better methods for achieving the same goals.

The purpose of this section is not to attempt to select certain practices or designs and require that only those are used. It is not possible to evaluate all the known practices and make determinations as to which are "best", nor is it advisable. What is best must be determined as the result of a site specific investigation of the problem to be solved. What the RFO hopes to accomplish with this section of the appendix is to prescribe basic construction techniques that could be used regardless of project design or purpose.

Section 303(e) of the Clean Water Act and 40 CFR 130.5 require States to maintain a “Water Quality Management Continuing Planning Process.” The process must establish procedures for adoption and appeals which, among other items, address BMPs. BMPs are advisory rather than regulatory. They are a key element in a State Nonpoint Source Management Plan, with which the Federal Government must comply under Executive Orders 12088 and 12372, and Clean Water Act Sections 319(k) and 301(k). The practices described in this document are designed to meet the intent of the State of Wyoming’s BMPs for BLM approved activities. The reader is encouraged to review the State of Wyoming lists of BMPs which have been developed in response to the Clean Water Act and address silviculture, grazing and hydrology, and a policy statement in lieu of BMPs for minerals and oil and gas. (http://deq.state.wy.us/wqd/watershed.asp#non

MANAGEMENT PLANNING PROCESS

Standard practices or BMPs may develop through the National Environmental Policy Act (NEPA) process into stipulations prior to lease or grant issuance, or they may serve as a basis for Conditions of Approval (COA). If these practices (or newly developed techniques) are already incorporated into plans for development submitted by a permittee, such plans may be approved. BLM considers all project proposals; however it is the burden of the applicant to describe the design and construction techniques planned. If a project’s design, scheduling, and construction techniques can mitigate environmental concerns, construction may be allowed without COAs.

As directed by the Federal Land Policy and Management Act and bureau policy, the BLM has developed a three tiered resource management planning process to make land use planning decisions (see Appendix 21: Adaptive Management Plan). These tiers are policy, resource management plans, and activity plans.

Areas of accelerated soil erosion, poor or unstable soils, eroding stream channels, and threatened or impaired stream reaches for water quality (see Appendix 18: Water Quality and Depletions) can be identified as issues during the resource management plan tier of the process or through stakeholder groups with local organizations on listed water bodies. Soil and water conservation practices are addressed in a general fashion during the land use planning tier and in site-specific detail during the activity planning and implementation tier of the process.

The Bureau's nonpoint source strategy is to continue to:

- Provide cooperation and assistance to state agencies and conservation districts in the management of the public lands to reduce nonpoint source pollution sources.

- Incorporate water quality impacts, including nonpoint sources, into land management actions planned and implemented by the bureau and identify and address nonpoint source water quality issues in bureau activity plans for specific projects.

- Provide personnel and resources to identify nonpoint source pollution and control techniques through coordinated research efforts and the implementation of BMPs.

- Proactively implement program practices in conducting land use and land management activities to reduce or avoid water quality impacts and to improve water quality as necessary to meet management objectives and regulatory requirements.

To protect water quality from nonpoint source pollution, as applied by the RFO on BLM lands, the BMP program consists of: 1) defining practices, based on the best information available, that are expected to protect water quality; 2) monitoring to ensure the practices are applied; 3) monitoring to determine the effectiveness of practices; 4) mitigation to address unforeseen problems after the activity begins; and, 5) adjustment of design specifications of BMPs for future activities, where appropriate (See Appendix 21: Adaptive Management Plan). Typically a site and/or project specific NEPA analysis will define practices and specify monitoring needs if applicable. The project proponent would then be responsible to mitigate unforeseen problems as they arise, typically with BLM review, and the BLM would be responsible to make adjustments to the process or methods used and as needed after each project.

The Wyoming BLM policy on reclamation assumes that an area can and shall be ultimately reclaimed, and requires that every surface disturbance on public lands receive attention for short-term stabilization and long-term reclamation. Mitigation measures or BMPs reduce, to the extent possible, the amount of reclamation that ultimately must take place. The permit or authorization is the means provided for ensuring that mitigation measures or Conditions of Approval (COA) are implemented. Compliance inspections during operations ensure that mitigation, COA and/or stipulations are being followed.

Watershed Protection

The entire land surface should be considered for nonpoint pollution control, with specific attention given to areas where the flow of water is concentrated naturally or due to construction

(including roads, well pads, drainage ditches and steam channels). Stream sediment, phosphate, and salinity load would be reduced where possible.

The following standard practices are to protect watershed function:

- Construction of ephemeral, intermittent, and perennial streams crossings associated with road and utility line construction would generally be restricted until after spring runoff and until normal flows are established.

- The inner gorge of intermittent and ephemeral drainages should be burned in such a manner as to leave unburned patches of vegetation. The use of herbicides for vegetative manipulation should proceed with great care when in the proximity of willows, cottonwoods, or aspens, so as not to damage such stands unless the prescription actually calls for such removal.

- Herbicide loading sites would be located at least 500 feet from live water, floodplains, riparian areas, and all special status plant locations.

- Vegetative buffer strips should be maintained between developed recreational facilities and live water. Prior to installing toilet facilities associated with recreation, ground water protection should be provided for.

- Installation of instream structures for fisheries, watershed, or irrigation enhancement should be completely engineered if the high flow for the stream exceeds 10 CFS (cubic feet/second).

- To minimize long-term surface disturbances within the vegetated sand dunes or other sensitive soils, options such as directional drilling, smaller well pads, and surface lines should be considered. To enhance reclamation success through surface stability, techniques to reduce wind erosion should be considered. These methods could include snow fences, soil tackifiers, and erosion control matting.

Floodplain protection is required by E.O.11988., in reference to federal real property and facilities. It states that facilities are to be located in a floodplain (i.e., when there is no practicable alterative), agencies shall ensure that flood protection measures are applied to new construction, or the agency can rehabilitate existing structures; elevate structures rather than fill the land; provide flood height potential markings on facilities to be used by the public; and, when the property is proposed for lease, easement, right of way, or disposal, the agency must attach restriction on uses in the conveyance or withhold from such conveyance.

For the most part standard practices to protect water quality and floodplains are to avoid surface disturbing activity in identified 100-yr floodplains, within 500 ft. of perennial waters and wetland/riparian and 100 ft. from the inner gorge of ephemeral channels. These buffers provide an opportunity for concentrated flows to be dispersed before they reach a water body and often preclude construction in riparian zones, except for linear features. Surface disturbing activities and permanent facilities placement avoid these buffers unless it is determined through site-specific analysis, that there is no practical alternative. If such a circumstance exists, then all practical measures to mitigate possible harm to the above areas are employed. These mitigating measures would be determined case by case and may include (but are not limited to) diking, lining, screening, mulching, terracing, and diversions.

Floodplains by their very nature are unsafe locations for permanent structures. With an inundation of flood waters, soils disturbed by construction could experience a rate of erosion greater than undisturbed sites. There is an additional concern over the potential for flood waters to aid in the dispersal of hazardous materials that may be stored within permanent structures. Therefore, floodplains should have no permanent structures constructed within their boundaries unless it can be demonstrated on a case-by-case basis that there is no physically practical alternative. In cases where identified 100-yr floodplain construction is approved, additional constraints would be applied through COAs.

Soils

Current objectives focus on soil conservation planning for surface disturbance actions. Soil conservation should be addressed during the initial phase of any surface disturbing action, thereby maintaining soil productivity and stability levels through the use of existing guidelines and techniques. Some areas may require more thorough soil management practices than others; however this is dependent on the type and duration of the action and the effect on site-specific soil characteristics.

Management of the soil resource would continue to be based on the following factors: (1) Evaluation and interpretation of soils in relation to project design and development, (2) Identification and inventory of soils for baseline data (soil surveys), and (3) Identification and implementation of methods to reduce accelerated erosion of top soil.

Evaluation and interpretation involves identification of soil properties that would influence their use, and recommendations for development while minimizing soil loss. Projects would be examined on a site-specific basis, evaluating the potential for soil loss and the compatibility of soil properties with project design. Stipulations and mitigating measures are provided on a case-by-case basis to ensure soil conservation and practical management. Projects requiring soil interpretations include construction of linear right-of-way facilities (i.e., pipelines, roads, railroads, and power transmission lines); construction of water impoundments; rangeland manipulation through fire or mechanical treatments; construction of plant site facilities, pump stations, well pads, and associated disturbances; and reclamation projects.

Soil surveys are designed to update general soils information and provide data to those areas lacking soil inventories. Allotments and areas impacted by oil and gas projects will receive priority in the soil survey process and BLM will encourage and participate in soil surveys as opportunities arise.

Before a surface disturbing activity is authorized, topsoil depth would be determined. The amount of topsoil to be removed, along with topsoil placement areas, would be specified in the authorization. The uniform distribution of topsoil over the area to be reclaimed would be required unless conditions warrant a varying depth. On large surface disturbing projects (e.g., gas processing plants), topsoil would be stockpiled and seeded to reduce erosion. Where feasible, topsoil stockpiles would be designed to maximize surface area to reduce impacts to soil microorganisms. Stockpiles remaining less than two years are best for soil microorganism survival and native seed viability. It is recommended that stockpiles be no more than 3 to 4 feet high. Areas used for spoil storage would be stripped of topsoil before spoil placement. The replacement of topsoil after spoil removal would be required.

Some examples of standards applied throughout the Field Office area based on soil management criteria are as follows:

- Individual road closures due to saturated soil conditions when soil resource damage would occur due to wheel rutting or compaction of wet soils
- Salvage and subsequent replacement of topsoil whenever possible on surface disturbing activities
- Avoiding disturbance on unstable slopes or slopes greater than 25 percent.
- Identification of critical erosion condition areas during site-specific project analysis, and activity plan development for the purpose of avoidance and special management.
- Temporary disturbances which do not require major excavation (e.g., small pipelines and communication lines) may be stripped of vegetation to ground level using mechanical treatment, leaving topsoil intact and root mass relatively undisturbed.

Uncontrolled settlement of clay particles does not provide a consistently adequate seal on a stock pond or reservoir. Compaction or permeability testing should be used to determine pit characteristics in conjunction with BLM engineers. If clay soils are used as stock pond lining, they should have a liquid limit greater than 30 and a Plasticity Index of at least 20. Assuming that bentonite would sufficiently seal a pit is not a good procedure, because the bentonite must be adequately compacted, with uniform coverage and density. If not, a chemical reaction may occur between the bentonite and native soil partilces. Bentonite is also subject to cracking if it is not designed properly and the layer may be penetrated by hooves if not buried sufficiently.

In general, emphasis should continue to be placed on the reduction of soil erosion and sediment. Of particular importance would be those areas with saline soils or those areas with highly erodible geology and soils.

Air-Born Dust and Air Quality

BLM actions must comply with all applicable air quality laws, regulations, and standards. As projects are proposed that include possible major sources of air pollutant emissions, air quality protection-related stipulations are added to BLM permits and rights-of-way grants. In addition BLM coordinates with the Wyoming Department of Environmental Quality, Air Quality Division, during the process of analysis. This coordination results in technical review of applications for permits and/or identification of additional stipulations to be applied to these permits.

Dust Control: The following standard practices limit the emission of fugitive dust:

- The use of water or chemicals to control dust in the demolition of structures, in construction operations, grading of roads, or clearing of land.
- The use of water for dust abatement may be considered on a case-by-case basis. The water should meet state standards for this use and be permitted by the State of Wyoming. Only the water needed for abating dust should be applied; this method should not be used as a water disposal option under any circumstances. There should be no traces of oil or solvents in water used for dust abatement.
- All weather surfacing of roads using gravel or asphalt paving and the application of water or suitable chemicals to keep dust in place on roads or materials stockpiles.
- Appropriate road design including shape, drainage and surface material to protect road bed from being eroded.

Prescribed Fire Emissions: The emissions that may be created directly by BLM activities are mitigated. Prescribed fires are conducted to reduce emissions by burning only at appropriate fuel moistures and wind speeds (among other factors), which reduce as much as possible the smoke created in locations near populated areas. All BLM activities that may potentially cause undesirable air quality impacts are also coordinated with the Wyoming DEQ-AQD. Permits to conduct these activities are secured (where necessary) before the activity begins, to ensure compliance with all federal, state, and local air quality laws.

Pipelines and Communication Lines

Existing roads would be used for access to utility lines where possible to minimize surface disturbances. Where possible, clearing of pipeline and communication line rights-of-way would be accomplished with the least degree of disturbance to topsoil. Where topsoil removal is necessary, it would be stockpiled (wind-rowed) and respread over the disturbance after construction and backfilling are completed. Vegetation removed from the right-of-way would also be required to be respread to provide protection, nutrient recycling, and a seed source.

On ditches exceeding 36 inches in width, 6 to 12 inches of surface soil should be salvaged where possible from disturbed sites. When pipelines and communication lines are buried, there should be at least 48 inches of backfill on top of the pipe. Backfill should not extend above the original ground level after the fill has settled. Bladed surface materials would be respread on the cleared route once construction is completed.

To promote soil stability, the compaction of backfill over the trench would be required (not to extend above the original ground level after the fill has settled). Water bars, mulching, and terracing would be required as needed to minimize erosion. Instream protection structures (e.g., drop structures) may be required in drainages crossed by a pipeline to prevent erosion.

For communication lines or other small lines like plastic water lines that do not require trenching, a ditch witch or similar trenching machine should be used to reduce disturbance and the need for reclamation.

Grazing BMPs

Proper grazing is the practice of managing forage harvest by all grazing animals including domestic livestock at a sustainable yield that does not accelerate erosion and sedimentation above acceptable levels for the receiving waters. Proper grazing will maintain or increase plant cover including residue, which should in turn slow down or reduce runoff and increase water infiltration. Allotment management plans, conservation plans or similar documents should contain a list of the BMPs most appropriate for the area. Management plans must be developed with reasonable goals and objectives and progress toward goals and objectives must be monitored. Monitoring must include measures of actual changes in resource conditions as well as measurements of completion of objectives and tasks. BMPs have been developed for Domestic Animals, Wildlife (Big Game Animals), Wildlife (Small Game and Nongame Animals), Wild Horses, Proper Grazing - Riparian and Wetland Areas, Fencing , Livestock Herding, Access Roads, Water Development - Instream and Offstream, Land Treatment – Biological, Land Treatment – Mechanical, Weed and Pest Management, and Windbreaks (Wyoming DEQ, 1997).

BLM Healthy Rangelands Standards and Guidelines (Appendix 14) will be used for assessment of water quality issues associated with BLM activities. Allotments are evaluated based on these criteria and BMPs can be developed within Allotment Plans to improve or maintain these standards. Included in these assessments are an evaluation of water quality, wetland/riparian areas, and upland conditions among other factors. These serve as the guidance and goals for Allotment Plans and would be used to evaluate monitoring and apply the Adaptive Management Plan (Appendix 21). These BMPs are developed at the site specific level of planning to account for local constraints and conditions.

Many grazing systems exist. There is no single system for all vegetation types. The proper system or combination of systems must be selected to fit any given site. Consideration must be given to season of use, soil type, precipitation, range condition, stocking rates, type of livestock, plant growth rates, and ecological site potential. The numbers of all grazing animals should be maintained in balance with their habitat. Options for developing a grazing management system at a particular location include but are not limited to:

- Livestock stocking rates
- Wild horse and/or wildlife densities
- Livestock, wild horse or wildlife distribution
- Timing and duration of each rest (including complete rest) and grazing period
- Livestock kind and class
- Forage allocation for livestock, wildlife and wild horses
- Water developments to improve distribution
- Salt/mineral supplements (these should be located away from water sources)
- Livestock access control
- Rehabilitation measures

Well Pads and Facilities

Site specific reclamation procedures would be developed in each Application for Permit to Drill (APD), Right-of-way (ROW) application, or Sundry Notice submitted to the BLM for review and approval prior to the authorization of surface-disturbing activities, mitigation measures can be applied.

Both produced water and reserve pits should be constructed to ensure protection of surface and groundwater. The review to determine the need for installation of lining material should be done on a case-by-case basis and consider soil permeability, water quality, and depth to ground water. Oil-based muds would be allowed in closed drilling systems. Drill cuttings and any remaining oil- based drilling fluids would be disposed in an environmentally acceptable manner. Pits should be lined if there is not sufficient clay in the building material to prevent infiltration of fluids into shallow groundwater.

Reserve pits would not be located in areas where ground water is less than 50 feet from the surface and soil permeability is greater than 10^{-7}cm/hr. If ground water is encountered during

the setting of the conductor, a closed drilling system will be used. Pits would be fenced as specified in individual authorizations. Any pits with harmful fluids in them shall be maintained in a manner that would prevent migratory bird mortality. Drilling pits are exempt from hazardous waste regulations as long as they are covered with 5 feet of soil after use.

Abandoned sites must be satisfactorily rehabilitated in accordance with a plan approved by BLM (see restoration section). Soil samples may be analyzed to determine reclamation potential, appropriate reseeding species, and nutrient deficits. Tests may include pH, mechanical analysis, electrical conductivity, and sodium content. Terraces or elongated water breaks would be constructed after slope reduction. Disturbances should be reclaimed or managed for zero runoff from the location until the area is stabilized. All excavations and pits should be closed by backfilling and contouring to conform to surrounding terrain. On well pads and larger locations, the surface use plan would include objectives for successful reclamation, including soil stabilization, plant community composition, and desired vegetation density and diversity.

On producing locations, operators would be required to reduce slopes to original contours (not to exceed 3:1 slopes). Areas not used for production purposes should be backfilled and blended into the surrounding terrain and reseeded. Erosion control measures should be installed, as they would be required after slope reduction. Facilities would be required to approach zero runoff from the location to avoid contamination and water quality degradation downstream. Mulching, erosion control measures, and fertilization may be required to achieve acceptable stabilization.

Any produced water pit or drilling fluids pit that shows indications of containing hazardous wastes would be tested for the Toxicity Characteristic Leaching Procedure constituents. If analysis proves positive, the fluids would be disposed of in an approved manner. The cost of the testing and disposal would be borne by the potentially responsible party.

No surface disturbance is recommended on slopes in excess of 25 percent unless erosion controls can be ensured and adequate revegetation is expected. Engineering proposals and revegetation and restoration plans would be required in these areas.

Reclamation

Current BLM policy recognizes that there may be more than one correct way to achieve successful reclamation, and a variety of methods may be appropriate to the varying circumstances. BLM should continue to allow applicants to use their own expertise in recommending and implementing construction and reclamation projects. These allowances still hold the applicant responsible for final reclamation standards of performance. All reclamation needs to conform to BLM reclamation policy (BLM, 1990a)

BLM reclamation goals emphasize (1) protection of existing native vegetation, (2) minimal disturbance of existing environment, (3) soil stabilization through establishment of ground cover, (4) establishment of native vegetation consistent with land use planning, and (5) monitoring and management of the reclamation sites to evaluate reclamation success.

All reclamation is expected to be accomplished as soon as possible after the disturbance occurs, with efforts continuing until a satisfactory revegetation cover is established and the site is stabilized (3 to 5 years). Only areas needed for construction would be allowed to be disturbed.

On all areas to be reclaimed, seed mixtures would be required to be weed-free and site-specific, composed of native species, and would be required to include species promoting soil stability. A predisturbance species composition list must be developed for each site if the project encompasses an area where there are several different plant communities present. Livestock palatability and wildlife habitat needs would be given consideration in seed mix formulation. BLM guidance for native seed use is BLM Manual 1745 (Introduction, Transplant, Augmentation, and Reestablishment of Fish, Wildlife, and Plants), and Executive Order No. 13112 (Invasive Species).

Interseeding, secondary seeding, or staggered seeding may be required to accomplish revegetation objectives. During rehabilitation of areas in important wildlife habitat, provision would be made for the establishment of native browse and forb species, if determined to be beneficial for the habitat affected. Follow-up seeding or corrective erosion control measures may be required on areas of surface disturbance which experience reclamation failure.

Trees, shrubs, and ground cover (not to be cleared from rights-of-way) would require protection from construction damage. Backfilling to preconstruction condition (in a similar sequence and density) would be required. Restoration of normal surface drainage would also be required.

Any mulch used would be free from mold, fungi, or noxious or invasive weed seeds. Mulch may include native hay, small grain straw, wood fiber, live mulch, cotton, jute, synthetic netting, and rock. Straw mulch should contain fibers long enough to facilitate crimping and provide the greatest cover.

The grantee or lessee would be responsible for the control of all noxious and invasive weed infestations on surface disturbances. Aerial application of chemicals would be prohibited within one-quarter mile of special status plant locations. Control measures would adhere to those allowed in the RFO Noxious Weed Control and Commercial Site Vegetation Control EA (WY-037-EA6-122), and Vegetation Treatment on BLM Lands in Thirteen Western States EIS and ROD (1991). Herbicide application would be monitored by the BLM authorized officer.

Types of Roads

Access Roads: Access roads should be kept to a minimum and used when dry or if all-weather surfaced. Adequate drainage and erosion minimization should be incorporated into road design. Roads should be designed to encourage the shedding of water from the surface before it gains enough concentration or velocity to cause erosion. After water is shed from the road surface energy dissipation structures should be designed, again with the goal in mind to reduce the concentration and velocity of water. There are two types of roads throughout the RFO, this discussion will be separated into two track undeveloped access roads and designed and maintained surfaced roads.

Undeveloped Two Track Roads: Use of undeveloped two tracks should be kept to a minimum and they should only be used during dry conditions, if possible. If areas are identified with multiple two tracks with the same destination, brush barriers or signing should be used to identify the best quality two-track road for use and discourage use of other unnecessary two tracks. As funding is available, these unnecessary two-tracks should be reclaimed.

If erosional features are present on necessary two tracks, including but not limited to excessive rutting with evidence of concentrated flow during storm events, sediment deposition adjacent to the two tracks, ponding in ruts, and/or ruts greater than 6 inches in depth; the road should be

considered for a designed surface road. If the road is not improved drainage should be improved by the installation of water bars, culverts, and/or wing ditches to reduce concentrated flows.

Developed or Designed Roads

Roads would be constructed as described in BLM Manual 9113. New main artery roads would be designed to reduce sediment loading to surface waters. Where necessary, running surfaces of the roads would be graveled if the base does not already contain sufficient aggregate. Developed roads would be upgraded to an all-weather surface if access will occur during winter mouths or if road is in sensitive soils.

All developed roads should be designed with and maintained to preserve some type of surface shape to reduce water concentration, surface flow, ponding and resulting safety and maintenance problems. Two commonly accepted surface shape designs are crowned roads where the center of the road is at the highest elevation and the sides are lower allowing for the shedding of water off the road surface and outsloped roads that shed water to the downslope side of the road. Insloping should only be used when outsloping or crowning is infeasible due to safety considerations or erosion on the outslope is a great concern, since drainage on the inslope will require ditches and cross-drainage. Outsloped or insloped roads should only be used on roads with less than 6 percent grade (BLM, 1982).

On surfaced road with grades greater than 8%, surface shape alone will probably not be enough to protect the road surface and cross-drainage systems should be considered (USDA, 1997). The two most common approaches are waterbars that shed water from the surface of the road and drainage ditches, or culverts to transport water from the road surface to a location where concentrated flow is dispersed. BLM manual section 9113 should be used for accepted specifications.

To control or reduce sediment from roads, guidance involving proper road placement and buffer strips to stream channels; surfacing; proper drainage; and in some cases, redesign or closure of old roads or seasonal closures, would be developed when necessary. Construction may also be prohibited during periods when soil material is saturated, frozen, or when watershed damage is likely to occur.

On newly constructed permanent roads, the placement of topsoil, seeding, and stabilization would be required on all cut and fill slopes unless conditions (e.g., rock) prohibit it. No unnecessary sidecasting of material (e.g., maintenance) on steep slopes would be allowed. Snow removal plans may be required so that snow removal does not adversely affect reclamation efforts or resources adjacent to the road.

Reclamation of abandoned roads would include requirements for reshaping, recontouring, resurfacing with topsoil, installing water bars, and seeding on the contour. The removal of structures such as bridges, culverts, cattleguards, and signs usually would be required. Stripped vegetation would be spread over the disturbance for nutrient recycling where practical. Fertilization or fencing of these disturbances would not normally be required. Additional erosion control measures (e.g., fiber matting) and road barriers to discourage travel may be required in addition to signing.

Road closures may be implemented during crucial periods (e.g., wildlife winter periods, spring runoff, and calving and fawning seasons). These would require signing or the areas being designated in a publicly available map.

Methods for shedding water from road surfaces: This can be done by installing water bars on steep sections and not allowing ruts to develop in others. Wear on access roads can be significantly reduced by minimizing use when they are wet. Good design on access roads that have a significant amount of traffic can include surfacing, installation of road drainage such as wing ditches, culverts and proper maintenance. As necessary for erosion control and energy dissipation structures such as wing ditches, riprap and culverts should be part of the road design. Riprap should be placed and outlets of culverts and the inlets of drainage structures, where possible. All riprap should be angular rock and placed on geotextile fabric Culverts should be considered for cross-drainage when travel is expected to exceed ten to fifteen vehicles per day, regardless of surface design and culverts should be 18 inches or greater in diameter (BLM Manual 9113).

Methods for designing road crossings: Active streams are those that maintain aquatic vegetation, animal or fish populations. Other stream crossings should follow BLM Manual 9113 specifications. The majority of active streams are intermittent or perennial; however there may be some portions of ephemeral systems that meet this definition. All crossings should consider the failure of the crossing during flows beyond the design capacity. This can be accomplished by allowing the road fill to be breached in pre-determined locations during storm events greater than the design capacity, and not diverting the water to a new pathway causing gullying, erosion, and formation of a new channel.

The goal of any design should be to maintain current fluvial processes for moving sediment and flow in the active channel. This results in designs that do not confine flows to only one portion of the channel or flood plain and do not result in a grade change through the crossing. Channel dimensions are a good indicator of the range of water, debris and sediment yield in the channel The active stream bed width or annual scour can be used as an estimate the area required for the crossing to pass typical (1.5 – 2 year reoccurrence) flows. Similarly, the eroded area with temporary vegetation and flood terracing can be used as indicators of extreme events for reoccurrence intervals greater than 2 years. These field measurements along with peak flow events (Miller, 2003) and other empirical methods should be used to determine design criteria for crossings.

In general, crossings designed to pass 100 year design storms would in most cases allow for unrestricted passage of flow and sediment form smaller storms. Crossing designs that simulate natural stream processes and provide unrestricted passage of flow and sediment can include bridges, low-water crossings, culverts, and bottomless culverts. The appropriate design should be chosen after careful consideration of local conditions including hydrologic conditions, soil erodibility, road utilization, and aquatic species presence.

Where new or replacement culvert designs are chosen for crossings of active streams, the Active Channel Design Option should be followed if the channel slope is less than 3%, the culvert is less than 100 feet in length, and passage is required for aquatic species. Design criteria specific to the Active Channel Design Option include the following:

- Culvert width – The minimum culvert width shall be equal to, or greater than, 1.5 times the active channel width.

- Culvert slope – The culvert shall be placed level (0% slope).
- Embedment – The bottom of the culvert shall be buried into the streambed not less than 20% of the culvert height at the outlet and not more than 40% of the culvert height at the inlet. Embedment does not apply to bottomless culverts.

At sites where the channel slope is greater 3% or culvert length would exceed 100 feet, additional consideration should be given to alternate design options such as bridges or low-water crossings due to the difficulty of providing for the passage of aquatic species through culverts installed at these sites.

Citations:

Bureau of Land Management, 1990. Wyoming Policy on Reclamation. U.S. Department of the Interior, Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming. February 2, 1990.

Miller, Kirk A., 2003. Peak-Flow Characteristics of Wyoming Streams. Water-Resources Investigations Report 03-4107. USDI US Geologic Survey, Cheyenne, Wyoming, 2003.

Wyoming DEQ, 1997. Best Management Practices for Grazing: Brochure. Developed by the Wyoming Department of Environmental Quality – Non Point Source Pollution Program thorough a grant from the US Environmental Protection Agency.

(USDA, 1997) Traveled Way Surface Shape. USDA Forest Service, Technology & Development Program, October 1997.

APPENDIX L

RESOURCE CONCERNS AND ASSOCIATED PROTECTION MEASURES PROPOSED UNDER ALTERNATIVE C

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Water and Soil Management		
Steep Slopes >25%, From 30 meter DEM data. These less steep slopes present more complexity in planning, road design, and can require larger pads. **Appendix M Maps: Alternative C--Slopes >25%**	1) No pad, compressor or water transfer sites can be located in these areas.	Wyoming Standard Mitigation Guidelines
Perennial Waters, Wetlands, Identified on National Wetlands Inventory or PFC with 500ft. Buffer on waters and PFC. **Appendix M Maps: Alternative C—Perennial Surface Waters and Wetlands**	1) No pad, compressor or water transfer sites can be located in these areas.	E.O. 11990 and 11988
Topsoils with excess salts providing difficulty with reclamation. Reclamation success is essential for modification of impacts to surface hydrology, especially the interim reclamation. Increasing reclamation success has many benefits to other resources. **Appendix M Maps: Topsoils with Excess Salts**	1) Pump reserve pit and do earth work for reclamation right after drilling, put in top soil and plant first good season, interim reclamation will be completed one year after spud date. 2) Low impact road design for resource roads (roads into individual pads) on slopes < 5%, if road can be built with no side slopes. This will include ditch-witching utilities within the ROW, brush beating, some type of fabric or matting and gravel. 3) Improve road surface on newly constructed or improved local and collector roads with 95% compaction on the road base and non-chlorine dust abatement product or suitable alternative treatment each year. 4) Put together seed mix that includes salt tolerant plants.	Cumulative Impacts; Salinity concerns in the Colorado River Basin.
Soils with high runoff potential contribute to higher peak flows and can cause hillslope erosion by forming rills and gullies. **Appendix M Maps: Alternative C--Soils with High Runoff Potential**	1) Reduce pad density to 4 locations per section and the associated infrastructure and limit initial disturbance (i.e. short-term) total to < 20 acres per section. 2) Place waddles in any potential flow path and at culvert entrances and exits. 3) Deep ripping (18 inches or more) before planting to increase percolation. 4) Closed system, pitless, or shared pit drilling. 5) Low impact road design for resource roads (roads into individual pads) on slopes < 5%. This will include ditch-witching utilities within the ROW, brush beating, some type of fabric or matting and gravel. 6) Crimped weed-free hay stubble mulch to increase surface roughness.	Cumulative Impacts; the Colorado River basin has been a focus for sediment delivery and soil loss since the 1930s.

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Soils with severe road rating typically dominated by one soil particle size component and road bases can become very unstable with insufficient maintenance. **Appendix M Maps: Soils with Severe Road Rating**	1) Low impact road design for resource roads (roads into individual pads) on slopes < 5%. This will include ditch-witching utilities within the ROW, brush beating, some type of fabric or matting and gravel. 2) Improve road surface on newly constructed or improved local and collector roads with 95% compaction on the road base and non-chlorine dust abatement product or suitable alternative treatment each year.	Cumulative Impacts; the Colorado River basin has been a focus for sediment delivery and soil loss since the 1930s.
Soils with poor topsoil ratings make reclamation difficult and can leave soils susceptible to erosion. Reclamation success is essential for modification of impacts to surface hydrology, especially the interim reclamation. Increasing reclamation success has many benefits to other resources. **Appendix M Maps: Soils with Poor/Fair Topsoil Ratings**	1) Pump reserve pit and do earth work for reclamation right after drilling, put in top soil and plant 1st good season, interim reclamation will be completed 1 year after spud date. 2) Crimped weed-free hay stubble mulch to increase surface roughness. 3) Use silt fencing to reduce wind erosion during construction. 5) Apply soil amendments to increase reclamation success unless testing demonstrates no need for amendments.	Cumulative Impacts; the Colorado River basin has been a focus for sediment delivery and soil loss since the 1930s.
Vegetation Resources		
Vegetation communities on >8% slopes present reclamation difficulties. **Appendix M Maps**	Reduced initial surface disturbance (i.e. short-term) total to < 20 acres per section	
The limited geographic extent of certain vegetation communities and their importance to a variety of wildlife species warrant special consideration. **Appendix M Maps: Project Area with Vegetation Communities**	1) Avoid surface disturbances within aspen, juniper-woodland, mahogany, and serviceberry communities. 2) Limit surface disturbances within the silver sagebrush/bitterbrush vegetation community to < 20 acres/mi2.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002)
Rangeland Resources		
Loss of livestock; disruption of management operations.	1) Operators shall establish and enforce speed limits throughout the project area 2) Erect signs in lambing/calving areas, shipping pastures, or adjacent to working corrals to warn vehicle operators	

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Disruption of management operations. **Appendix M Maps: Project Area with Grazing Allotments**	1) Operators shall provide a plan specific to pastures or regions so livestock operators can plan activities/work around development to reduce conflicts	
Dust on vegetation and erosion	1) Improve road surface on newly constructed or improved local and collector roads with 95% compaction on the road base and non-chlorine dust abatement product or suitable alternative treatment each year	
Wildlife Resource Management		
Disturbance of greater sage-grouse and Columbian sharp-tailed grouse nesting & brood rearing habitat. **Appendix M Maps: Alternative C – Greater Sage Grouse**	1) Limit initial disturbance (i.e. short-term) total to < 20 acres per section	Minimum programmatic standards recommended by the Wyoming Game and Fish Department to sustain wildlife habitats affected by oil and gas development (WGFD 2004)
Disturbance of winter relief habitats for greater sage-grouse and Columbian sharp-tailed grouse. **Appendix M Maps: Alternative C – Grouse Severe Winter Relief Habitat**	1) No surface disturbance	Vegetation and Habitat Analysis of Critical Wintering Areas for Greater Sage-Grouse (HWA 2004b)
Disturbance of big game crucial winter range. **Appendix M Maps: Seasonal pronghorn antelope, mule deer and elk ranges (3 Maps)**	1) Limit initial disturbance (i.e. short-term) total to < 20 acres per section	Minimum programmatic standards recommended by the Wyoming Game and Fish Department to sustain wildlife habitats affected by oil and gas development (WGFD 2004)
Visual Resource Management		

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Failure to use special mitigations will result in a project that will exceed VRM Class III Management Objectives and therefore be out of compliance with Land Use Planning guidance. Minimizing surface disturbance and aboveground facilities will help minimize visual impacts. Maximizing facility distance from primary roads will help minimize visual impacts. Using any topographic screening available to hide facilities and roads will help minimize visual impacts. **Appendix M Maps: Alternative C--Areas Visible from Main Roads in VRM Class III with Slopes <5%**	In visible portions of VRM Class III areas (Map 4.9), the following apply: 1) Pads shall not be located on or near ridgelines - use subsurface or low-profile facilities to prevent protrusion above horizon line when viewed from any State, County or BLM road. 2) Maximize pad distance from State, County or BLM roads. 3) Low impact road design for resource roads (roads into individual pads) on slopes < 5%, if road can be built with no side slopes. This will include ditch-witching utilities within the ROW, brush beating, some type of fabric or matting and gravel. (See Map 2.6) 4) Minimize pad size - use pitless, shared pit or closed system drilling. 5) Pump reserve pit and do earth work for reclamation right after drilling, put in top soil and plant first good season, interim reclamation will be completed one year after spud date.	VRM BMPs for Fluid Minerals, VRM H-8400-1, Land Use Planning H-1601-1
Cow Butte/Wild Cow SMA		
Existing road network **Appendix M Maps: Alternative C—Special Management Areas Overview**	1) Road density within the SMA targeted for less than 3 miles/mile^2. 2) Where existing road paths do not provide sufficient lease access or are located within highly erosive soils or in proximity to sensitive wildlife resources, reclamation of existing roads (either inside or outside the ARPA) would provide for the construction of new road paths 3) Improvement of existing roads or construction of new roads would be designed to minimize hydrologic alteration. Specific road design criteria would be based on site-specific review and likely include a combination of mitigation options	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002). These roads are currently known to cause accelerated erosion and hydrologic alteration. Upgrading these roads to improved or low-impact design specifications would decrease these impacts while allowing vehicular access to lease holdings. Additionally, utilization of appropriate road designs would increase the effectiveness of the existing transportation network.

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Human presence	1) Existing levels of public access would be maintained. In most cases, this would require new and improved roads be gated. 2) Remote monitoring of well locations would be required where feasible.	Minimum programmatic standards recommended by the Wyoming Game and Fish Department to sustain wildlife habitats affected by oil and gas development (WGFD 2004). There is currently no public access to the majority of the SMA. Maintaining a limited human presence within this area would help to maintain a movement corridor for big game and limit disturbance of leks and raptor nests.
Wildlife movements	1) Convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement throughout the SMA, and in coordination with grazing permittees.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002). Improving big game movement through or across fences would help to mitigate the additional stresses of development within the ARPA.
Limited vegetation communities. **Appendix M Maps: Project Area with Vegetation Communities**	1) No surface disturbances within aspen, mahogany, and serviceberry communities.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002)
Historic Trails SMA		
Historic trail corridors **Appendix M Maps: Alternative C--Historic Trails and 2-Mile Visibility**	1) Brush hog and gravel surface for temporary roads at the drilling phase instead of constructing crowned and ditched roads on all locations. 2) Begin reclamation at the time most optimal to regenerate the native species. Replace native shrubs to decrease visibility. 3) Use existing roads/two-tracks if doing so would minimize visibility otherwise construct roads in minimally visible areas. 4) Limit trail crossings to existing corridors. 5) Construct smaller well pads. 6) Construct low-impact roads. 7) Require multiple well locations per pad in order to decrease visibility.	Wyoming State Protocol - Approved procedures for the implementation of Section 106 NHPA and 36 CFR 800
Historic trails within the ARPA	1) Allow no surface disturbance within ¼ mile of contributing segments of historic trails, including the Overland and Rawlins to Baggs Freight Road or the trail's associated sites. 2) Limit trail crossings to existing disturbance corridors.	Wyoming State Protocol - Approved procedures for the implementation of Section 106 NHPA and 36 CFR 800

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Upper Muddy Creek Watershed/Grizzly SMA		
Additional road development would alter hydrologic conditions that create and maintain key habitat features of importance to BLM sensitive fishes (Bower 2005). Given the limited distribution of these fishes, alteration of the suitability of habitats within the SMA would likely increase the validity of listing petitions under the Endangered Species Act. **Appendix M Maps: Alternative C—Special Management Areas Overview**	1) Road density within the SMA targeted for less than 3 miles/mile^2. 2) Transportation and well access roads would utilize existing road paths where feasible. 3) Where existing road paths do not provide sufficient lease access or are located within highly erosive soils or in proximity to sensitive wildlife resources, reclamation of existing roads within the SMA (either inside or outside the ARPA) would provide for the construction of new road paths 4) Improvement of existing roads or construction of new roads would be designed to minimize hydrologic alteration. Specific road design criteria would be based on site-specific review and likely include a combination of mitigation options 5) Detailed development, transportation, and reclamation plans, including road design, specific to those areas within the SMA will be required.	BLM Wyoming Sensitive Species List (USDI-BLM 2002a), BLM 6840 policy for special status species, Range-wide Conservation Agreement for Roundtail Chub, *Gila robusta*, Bluehead Sucker, *Catostomus discobolus*, and Flannelmouth Sucker, *Catostomus latipinnis* (UDNR 2004). These roads are currently known to cause accelerated erosion and hydrologic alteration. Upgrading these roads to improved or low-impact design specifications would decrease these impacts while allowing vehicular access to lease holdings. Additionally, utilization of appropriate road designs would increase the effectiveness of the existing transportation network.
Slopes > 8% within the Upper Muddy Creek Watershed/Grizzly SMA boundary from 30-m DEM. Road construction on steep slopes would exacerbate the alteration of hydrologic conditions that create and maintain key habitat features of importance to BLM sensitive fishes. **Appendix M Maps: Alternative C—Muddy Creek SMA Slopes >8%**	1) No surface disturbance 2) Detailed transportation plan required in order to avoid areas of > 8% slope	BLM Wyoming Sensitive Species List (USDI-BLM 2002a), BLM 6840 policy for special status species, Range-wide Conservation Agreement for Roundtail Chub, *Gila robusta*, Bluehead Sucker, *Catostomus discobolus*, and Flannelmouth Sucker, *Catostomus latipinnis* (UDNR 2004). Improved road designs frequently result in alteration of hydrologic conditions. Given the limited feasibility of utilizing low-impact road designs on slopes greater than 8%, these areas will be avoided.

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
1:24,000 NHD within the Upper Muddy Creek Watershed/Grizzly SMA boundary. The fragmentation of fish habitats and wildlife corridors as well as risks posed by the increased probability of exotic species introductions warrant avoidance of additional road crossings of Muddy Creek.	1) No new road crossings of Muddy Creek 2) Detailed development and transportation plan required in order to design access routes that avoid Muddy Creek	BLM Wyoming Sensitive Species List (USDI-BLM 2002a), BLM 6840 policy for special status species, Range-wide Conservation Agreement for Roundtail Chub, *Gila robusta*, Bluehead Sucker, *Catostomus discobolus*, and Flannelmouth Sucker, *Catostomus latipinnis* (UDNR 2004). Sufficient access to lease holdings can be provided through the transportation planning process.
Maintaining a limited human presence within this area would help to maintain a movement corridor for big game and limit disturbance of sage-grouse leks and raptor nests.	1) Existing levels of public access would be maintained. In most cases, this would require new and improved roads be gated. 2) Remote monitoring of well locations would be required where feasible.	BMP's, Minimum programmatic standards recommended by the Wyoming Game and Fish Department to sustain wildlife habitats affected by oil and gas development (WGFD 2004). There is currently no public access to the majority of the SMA.
Chloride deicing agents are toxic to a variety of plants, fish, and other aquatic organisms and tend to increase the mobility of chemical elements in soil, such as heavy metals (Amrhein 1992; National Research Council 1991).	1) Use only non-chlorine deicing and dust control agents within the Upper Muddy Creek Watershed/Grizzly SMA.	BLM Wyoming Sensitive Species List (USDI-BLM 2002a), BLM 6840 policy for special status species, Range-wide Conservation Agreement for Roundtail Chub, *Gila robusta*, Bluehead Sucker, *Catostomus discobolus*, and Flannelmouth Sucker, *Catostomus latipinnis* (UDNR 2004). Alternative, non-chloride deicing and dust control products are readily available.
The limited geographic extent of certain vegetation communities and their importance to a variety of wildlife species warrant special consideration.	1) No surface disturbances within aspen, juniper-woodland, true mountain mahogany, and serviceberry communities.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002)
The combination of increased disturbance of big game resulting from development activities and existing fragmentation of movement corridors by fences would likely result in increased mortality	1) Convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement throughout the SMA, and in coordination with grazing permittees.	BMP's, Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002). Improvement of big game movement through fences would help to mitigate the additional stresses of development within the ARPA.

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
Sand Hills SMA		
There is currently an extensive road network within the SMA including those portions within the ARPA. Reducing the density of roads within the area and incorporating appropriate designs when improving existing roads would help to reduce disturbance of the unique vegetation community important to big game, greater sage-grouse, and Columbian sharp-tailed grouse.	1) Net reduction in road density within the SMA to a target of less than 3 miles/mile^2 2) Transportation and well access roads would utilize existing road paths where feasible 3) Where existing road paths do not provide sufficient lease access or are located within sensitive vegetation, highly erosive soils, or in proximity to sensitive wildlife resources, reclamation of existing roads (either inside or outside the ARPA) would provide for the construction of new road paths 4) Improvement of existing roads or construction of new roads would be designed to minimize alteration of sensitive vegetation communities. 5) Detailed development, transportation, and reclamation plans, including road design, specific to those areas within the SMA will be required.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002). These roads are currently known to cause accelerated erosion of active dune complexes and associated disturbance of rare plant communities. Creation of new road paths would increase the potential for loss of rare vegetation communities through wind erosion of active dune complexes. The use of existing roads and appropriate designs for road improvement would allow for rapid revegetation and limit the disturbance of rare plant communities. Additionally, utilization of appropriate road designs would increase the effectiveness of the existing transportation network.
Maintaining a limited human presence within this area would help to maintain a movement corridor for big game and limit disturbance of leks and raptor nests.	1) Existing levels of public access would be maintained. In most cases, this would require new and improved roads be seasonally closed. 2) Remote monitoring of well locations would be required where feasible.	Minimum programmatic standards recommended by the Wyoming Game and Fish Department to sustain wildlife habitats affected by oil and gas development (WGFD 2004). There is currently no public access to the majority of the SMA.
Chloride deicing agents are toxic to a variety of plants and tend to increase the mobility of chemical elements in soil, such as heavy metals (Amrhein 1992; National Research Council 1991).	1) Use only non-chlorine deicing and dust control agents within the Sand Hills SMA	To protect the silver sagebrush/bitterbrush community. Alternative, non-chloride deicing and dust control products are readily available.
The limited geographic extent of certain vegetation communities and their importance to a variety of wildlife species warrant special consideration.	1) Limit surface disturbances within the silver sagebrush/bitterbrush community of the Sand Hills to < 20 acres/mi^2.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002). The Sand Hills plant community is unique within the State of Wyoming. It also provides important seasonal and crucial winter habitats to a variety of wildlife species.

Data Source Resource Concern	Protection Measure	Justification Assumptions for Analysis/Comments
The combination of increased disturbance of big game resulting from development activities and existing fragmentation of movement corridors by fences would likely result in increased mortality.	1) Convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement throughout the SMA, and in coordination with grazing permittees.	Standards and Guidelines assessment for Upper Colorado River Basin (BLM 2002). Improvement of big game movement through fence crossings would help to mitigate the additional stresses of development within the ARPA.
Historic Trails SMA	See Historic Trails SMA for special protective measures.	Wyoming State Protocol - Approved procedures for the implementation of Section 106 NHPA and 36 CFR 800
JO Ranch property **Appendix M Maps: Alternative C—Special Management Areas Overview**	1) No surface disturbance within the 18 acres surrounding JO Ranch Headquarters.	Wyoming State Protocol - Approved procedures for the implementation of Section 106 NHPA and 36 CFR 800

Appendix M

MAPS

This appendix contains maps referenced throughout the document and serves as a visual reference. The Bureau of Land Management shall not be held liable for improper or incorrect use of this data, based on the description of appropriate/inappropriate use described in this document. The distributor makes no claim for the data's suitability for other purposes.

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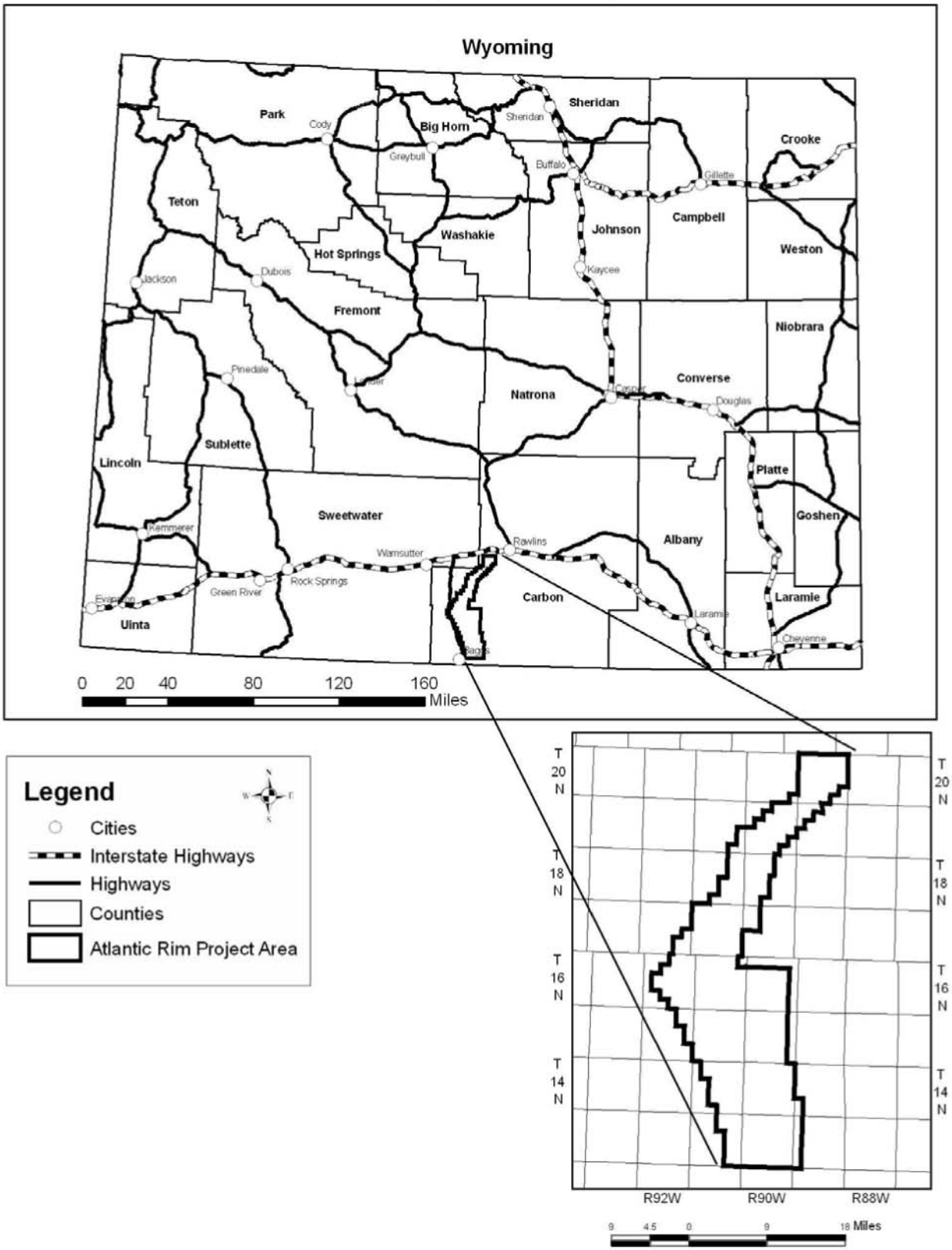
ATLANTIC RIM DRAFT EIS MAP
Project Area Map



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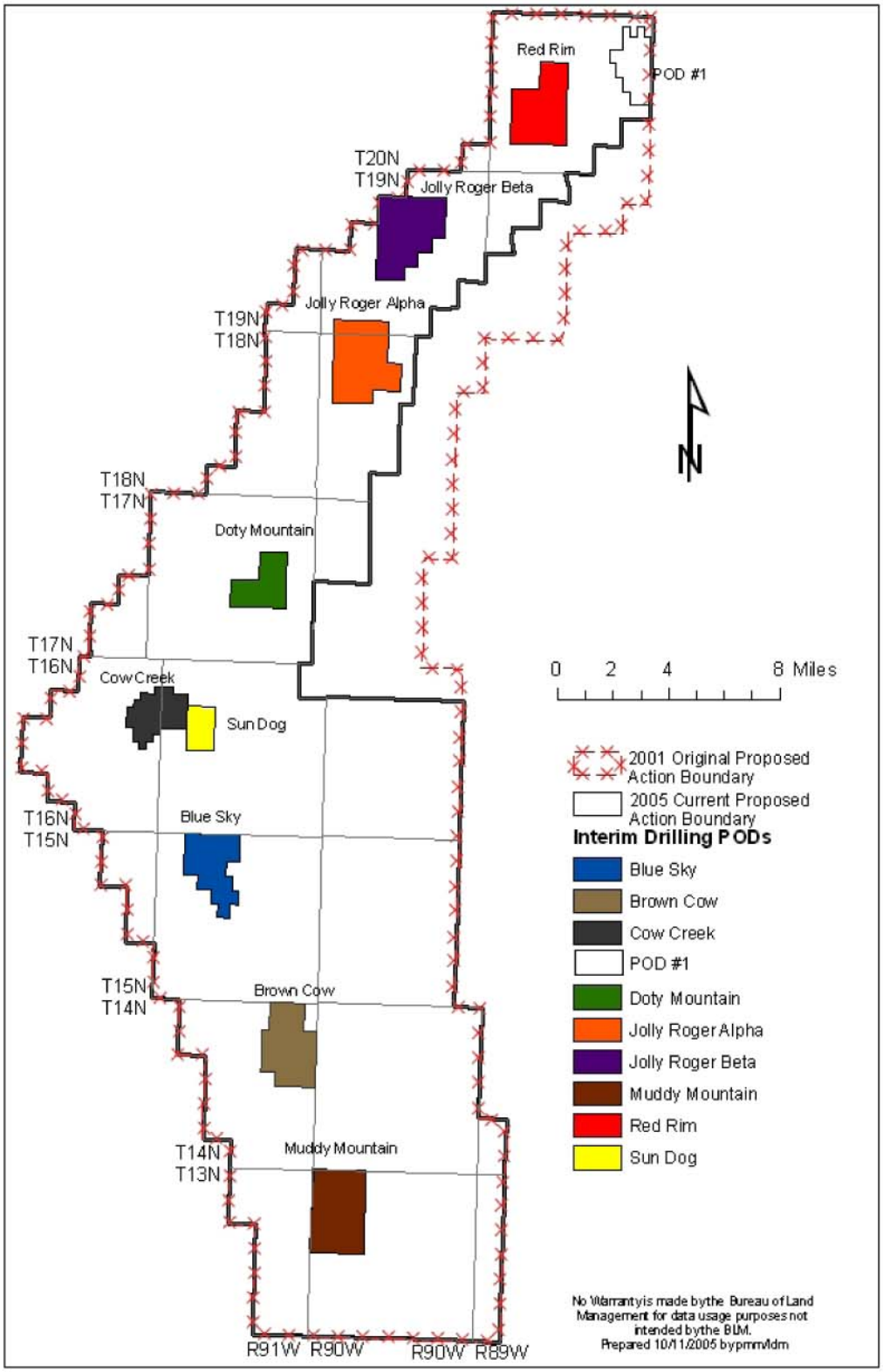
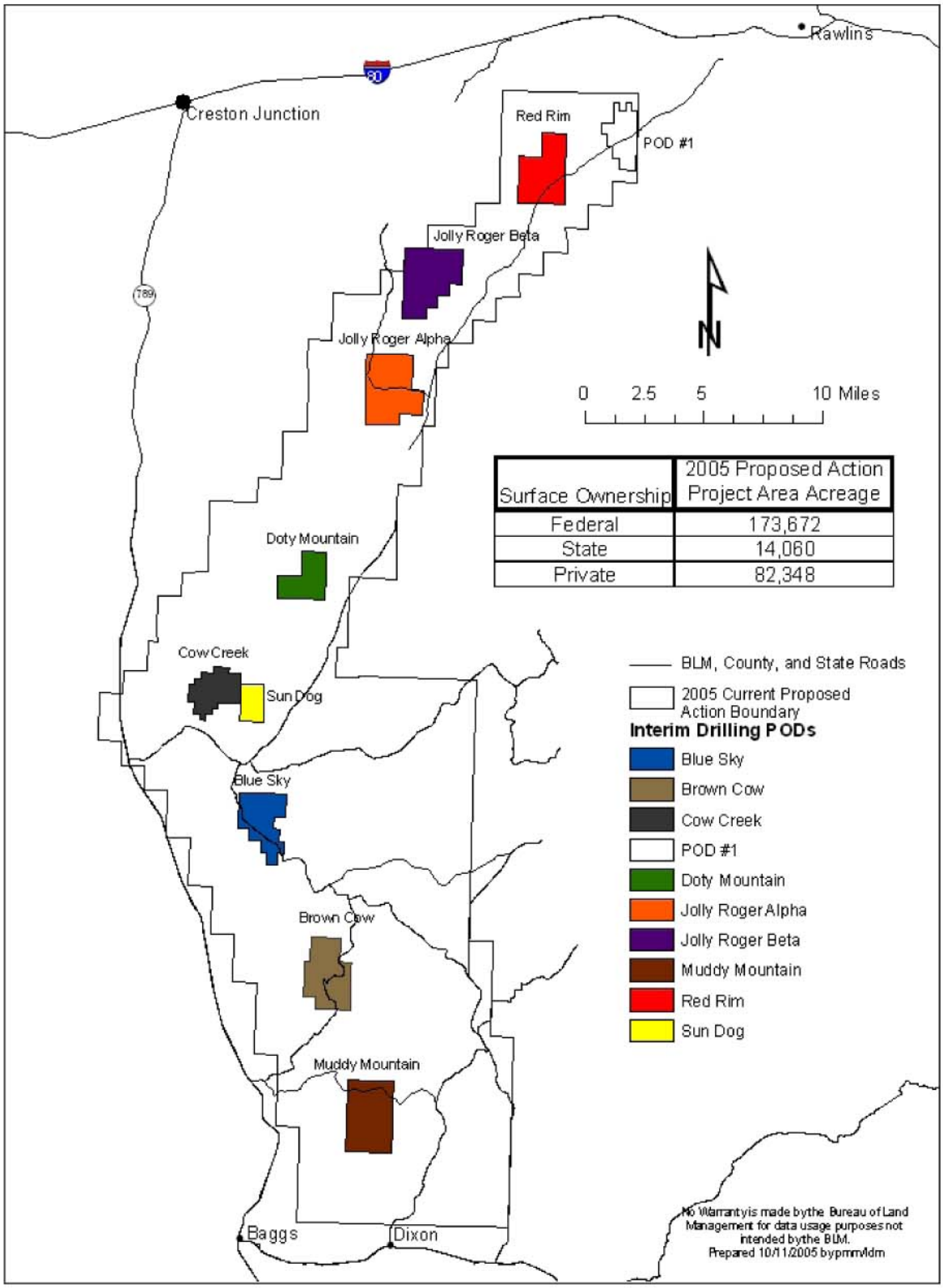
2001 Project Area

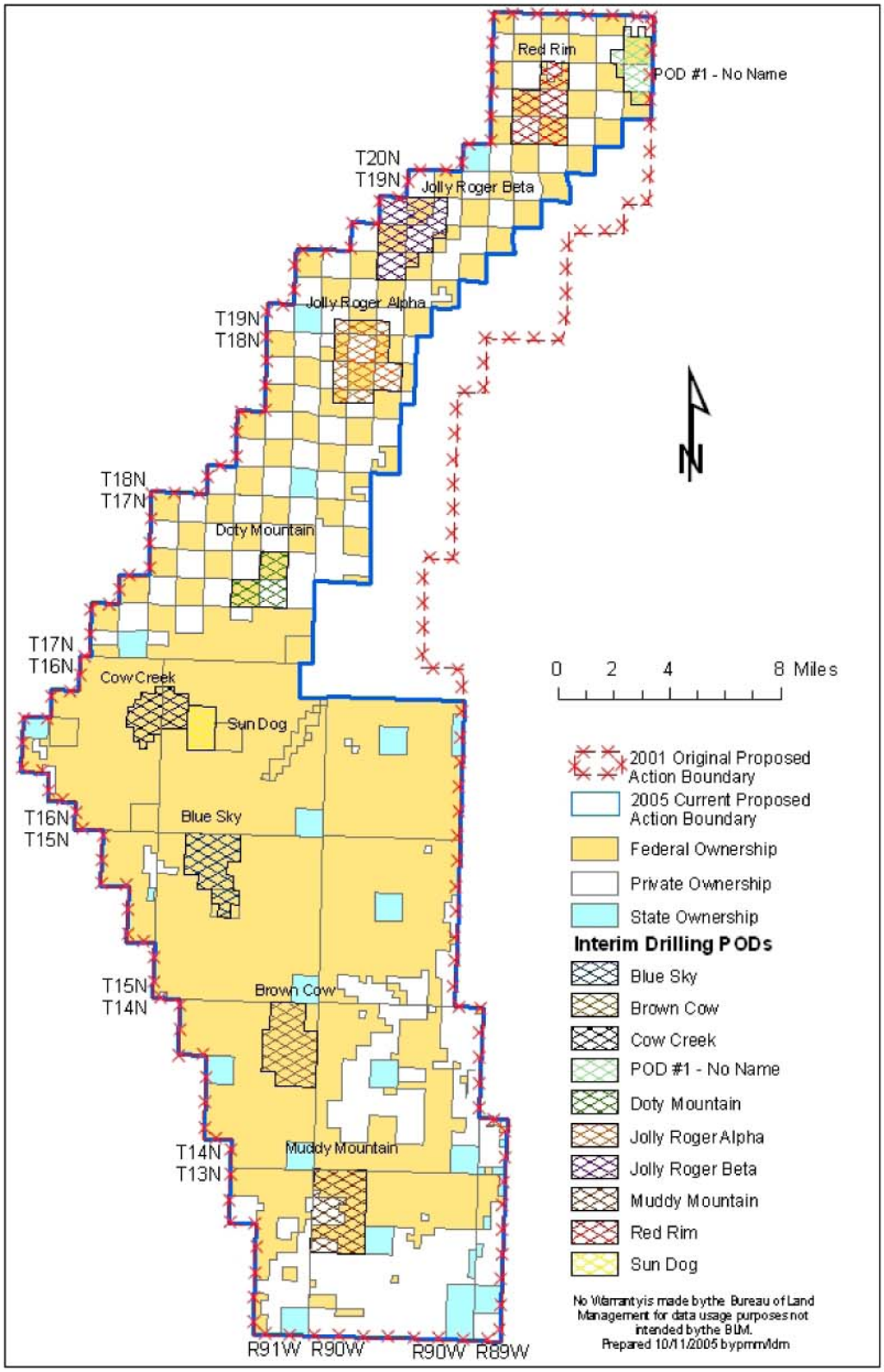


ATLANTIC RIM DRAFT EIS MAP
2005 Proposed Action Project Area

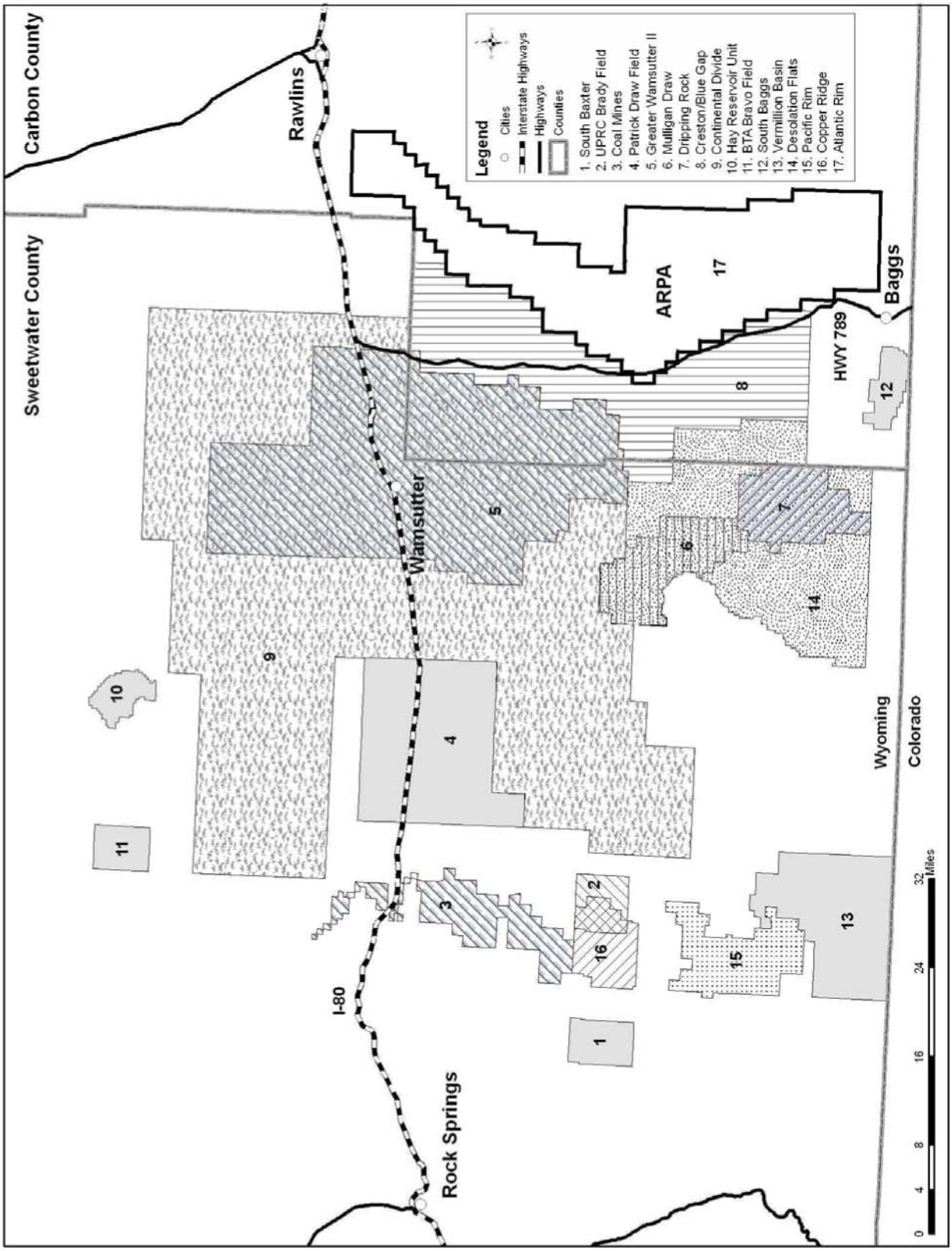


Surface Ownership	2005 Proposed Action Project Area Acreage
Federal	173,672
State	14,060
Private	82,348

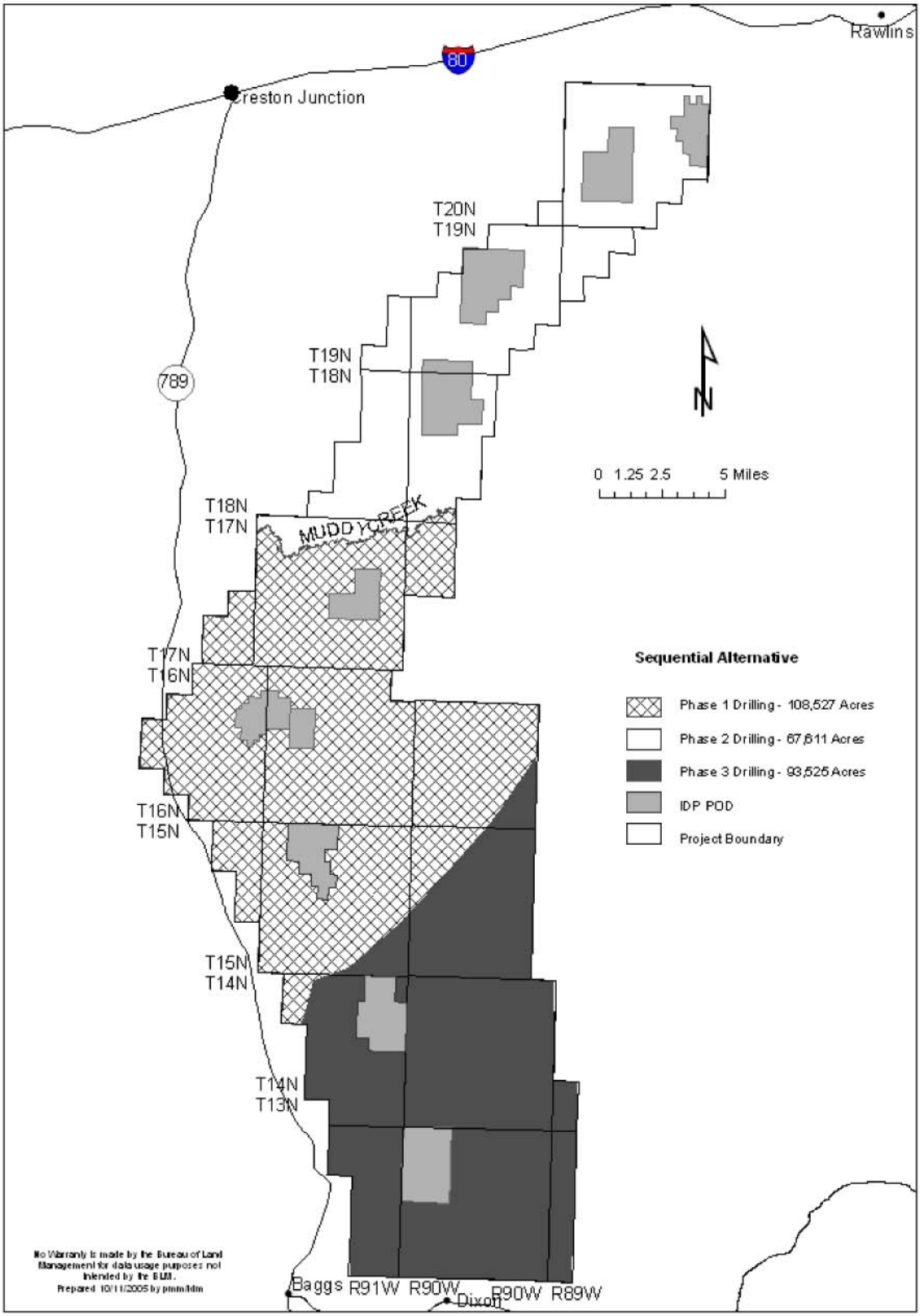
ATLANTIC RIM DRAFT EIS
Ownership



ATLANTIC RIM DRAFT EIS MAP
Mineral Development Projects in the Vicinity



ATLANTIC RIM DRAFT EIS MAP
Alternative B - Phases of Drilling and Drilling PODs



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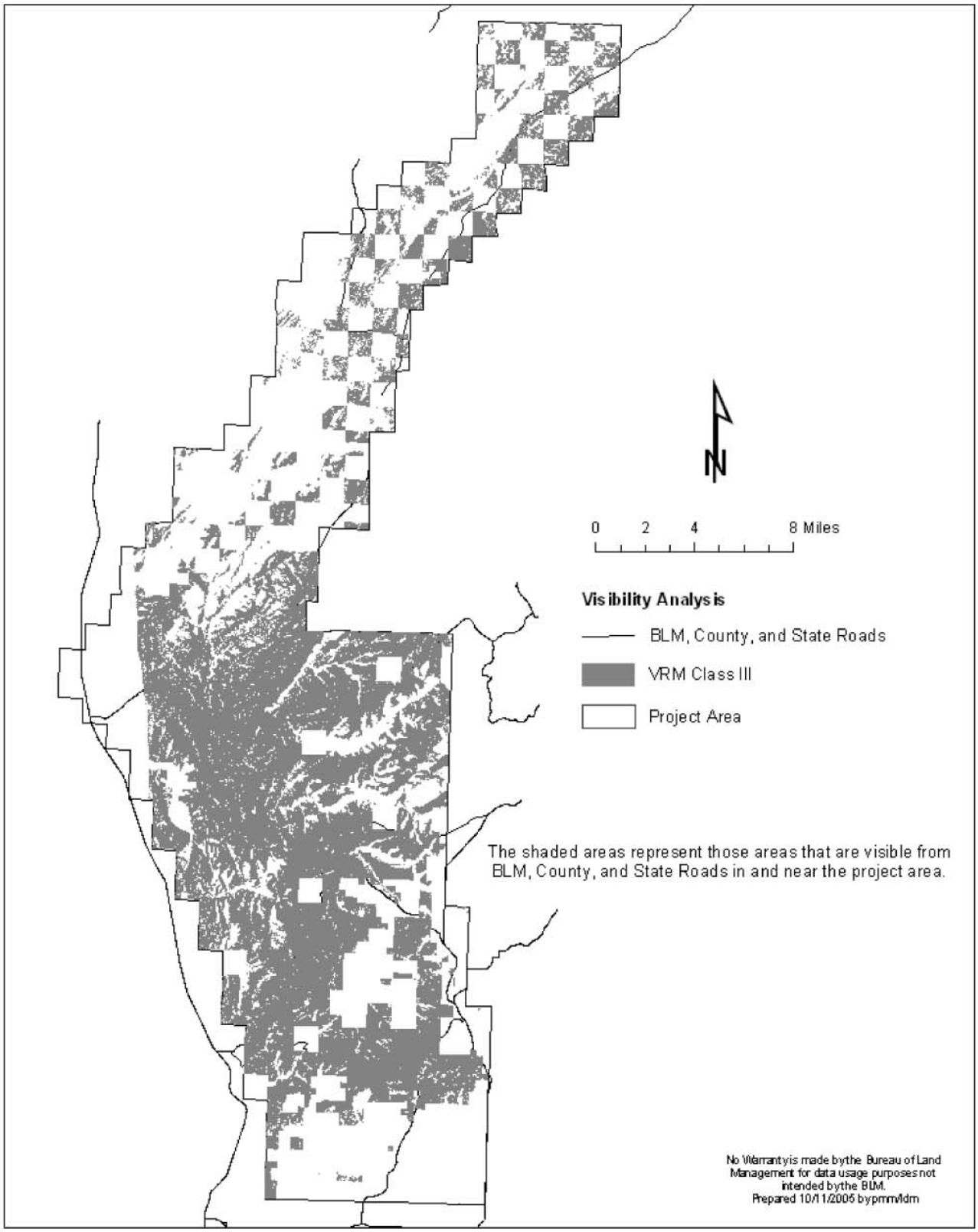
Areas Visible from Main Roads in VRM Class III



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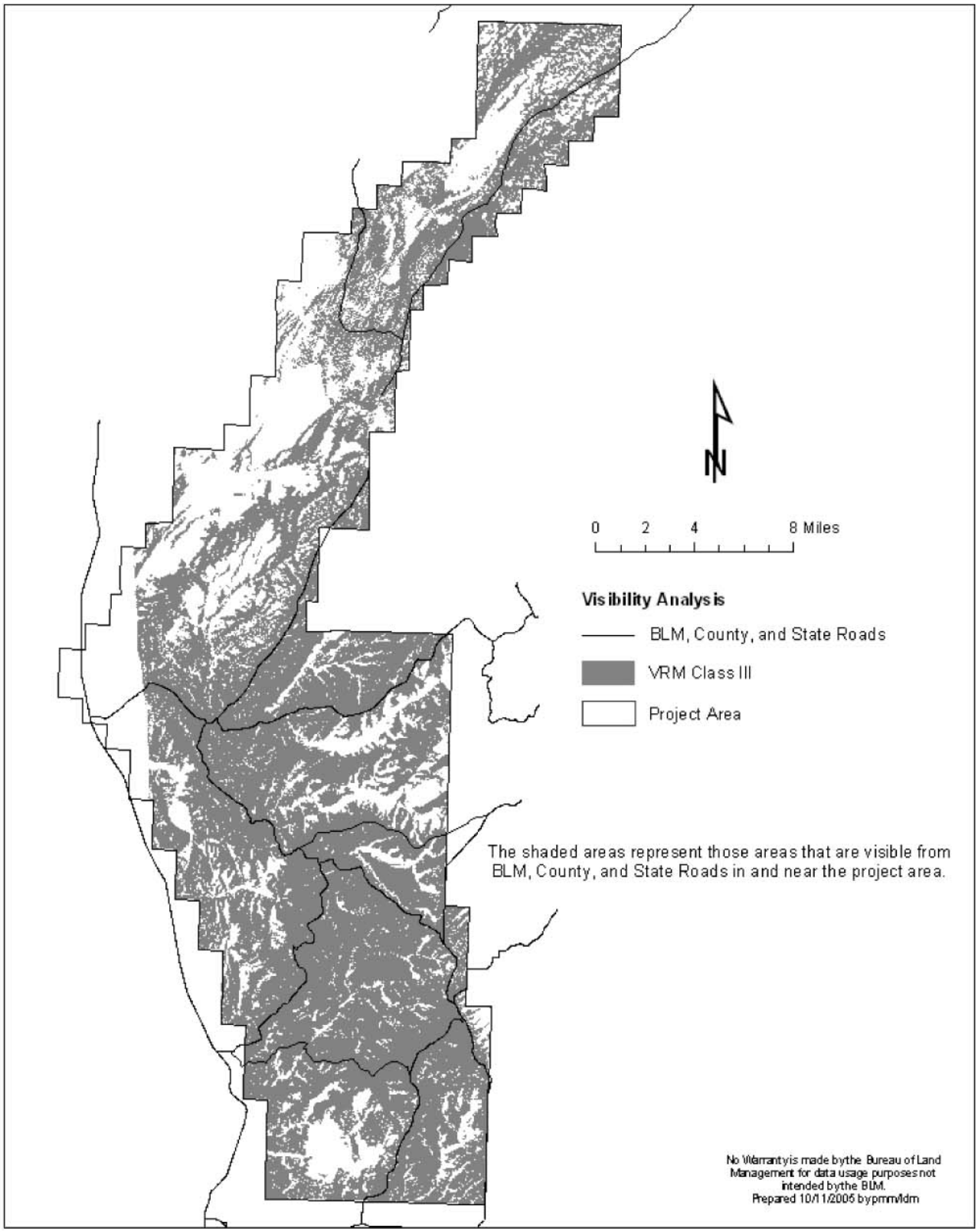
Areas Visible from Main Roads in VRM Class III



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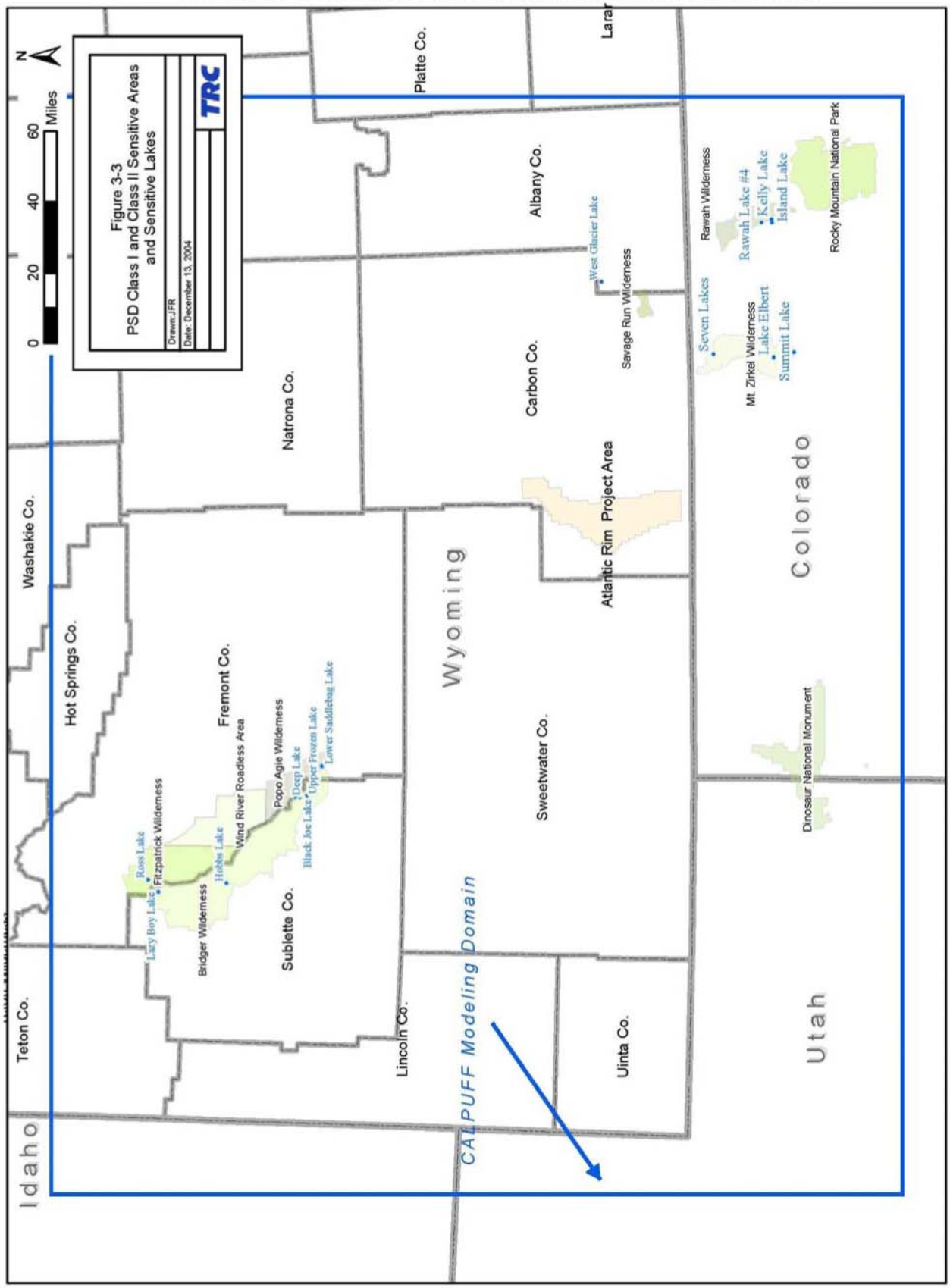
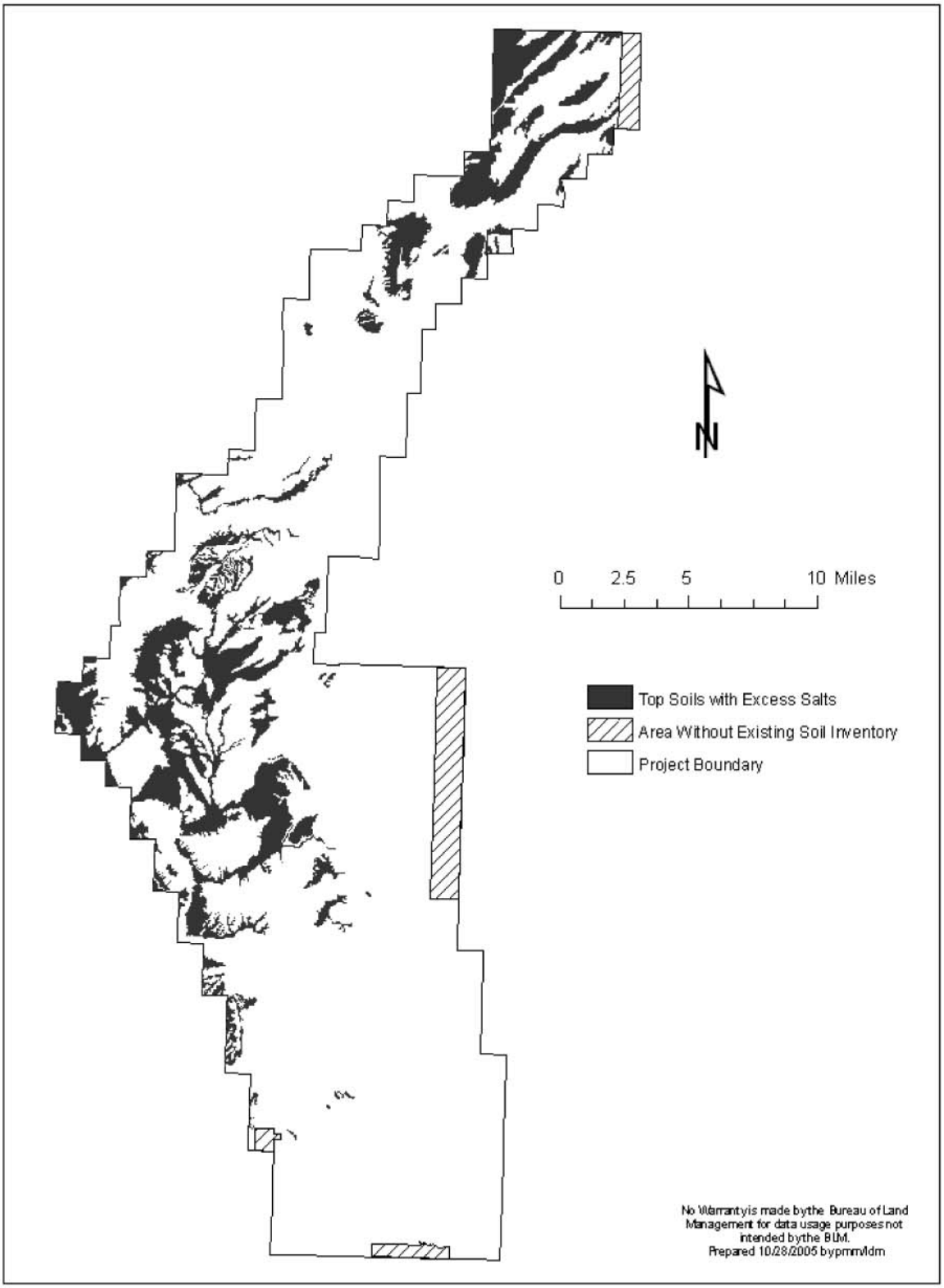
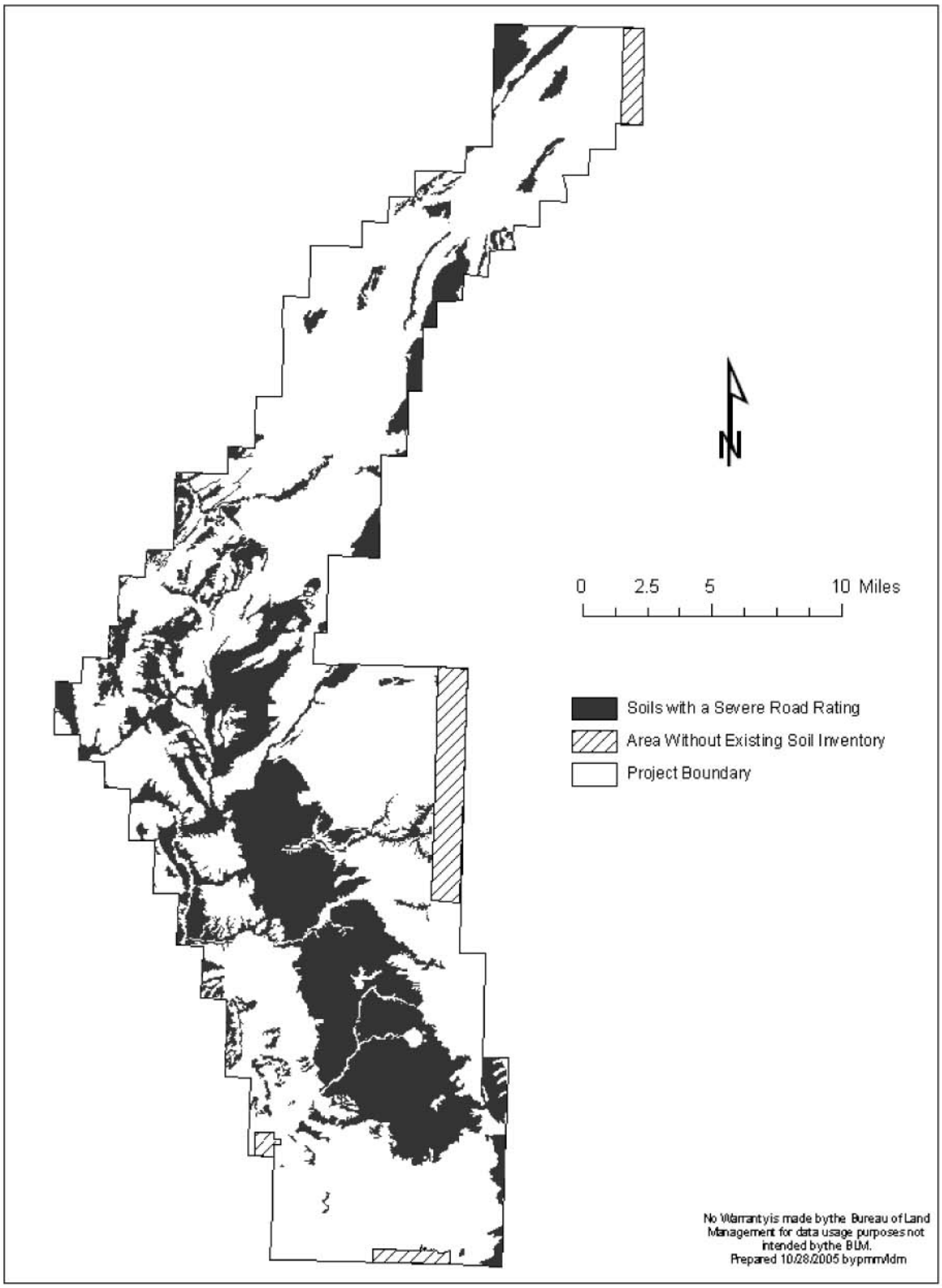
PSD Class I and Class II Sensitive Areas and Sensitive Lakes



ATLANTIC RIM DRAFT EIS MAP
Top Soils with Excess Salts



ATLANTIC RIM DRAFT EIS MAP
Soils with a Severe Road Rating



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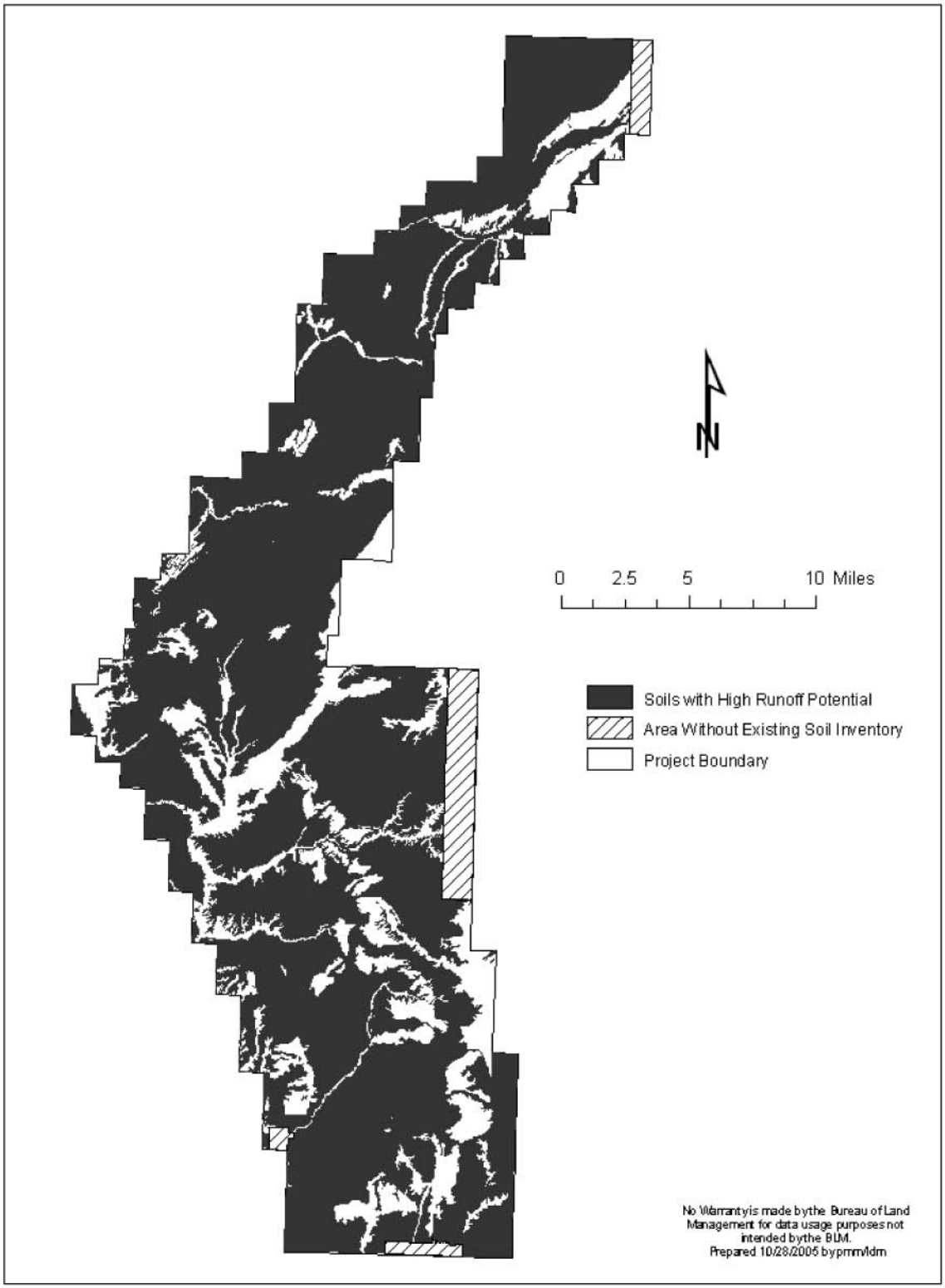
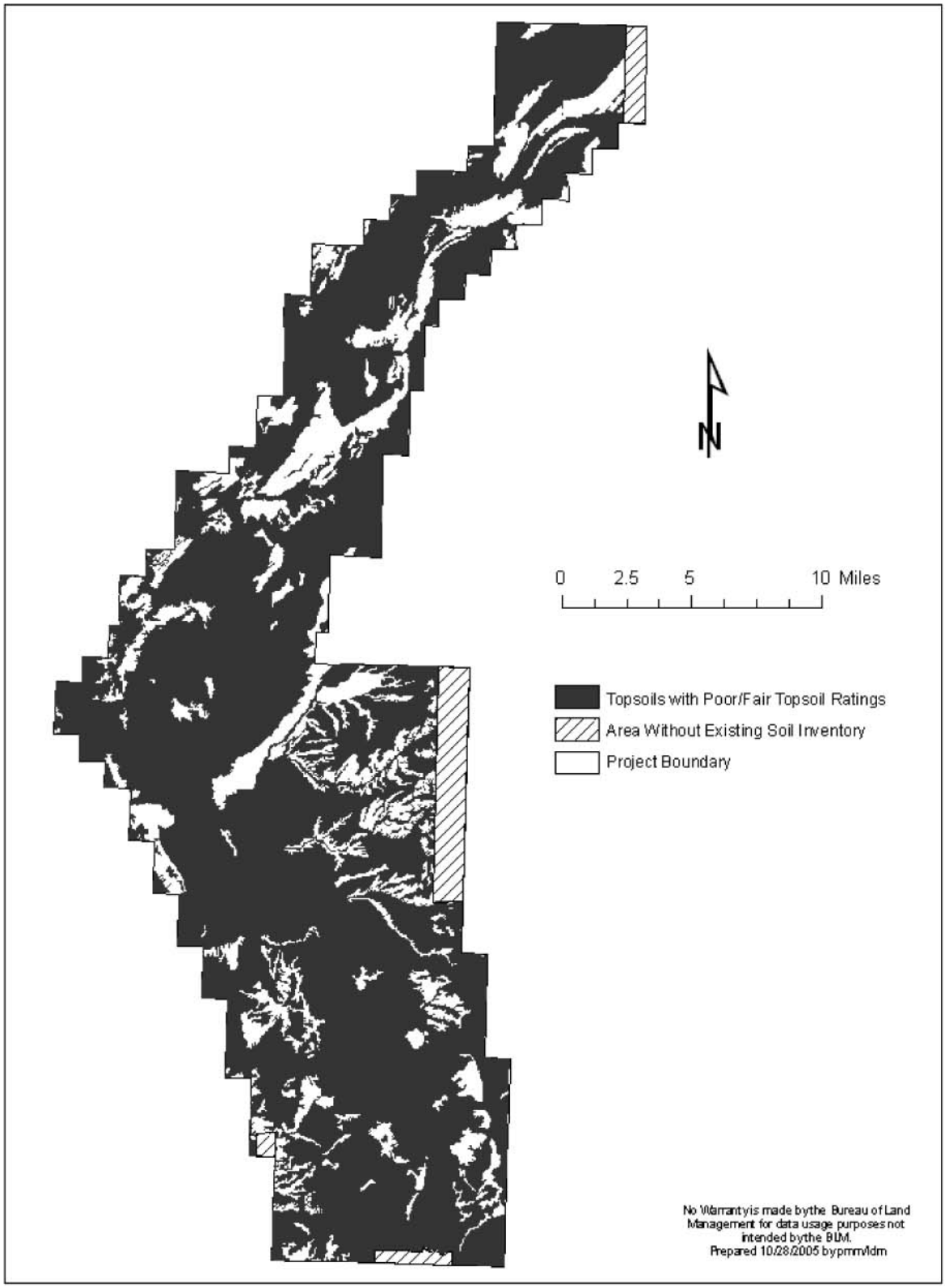
Soils with High Runoff Potential



ATLANTIC RIM DRAFT EIS MAP
Soils with Poor/Fair Topsoil Ratings



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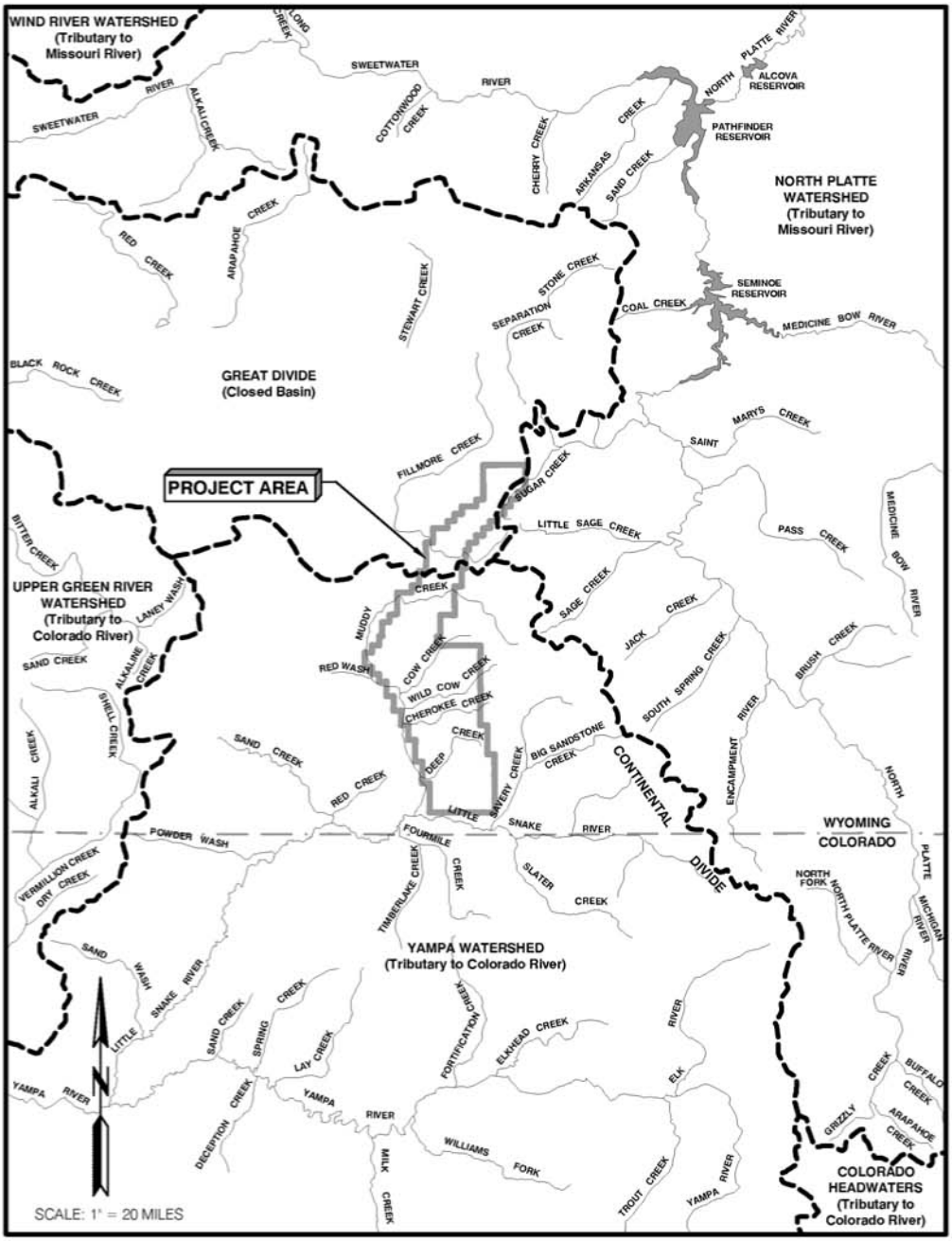
Watershed Basins



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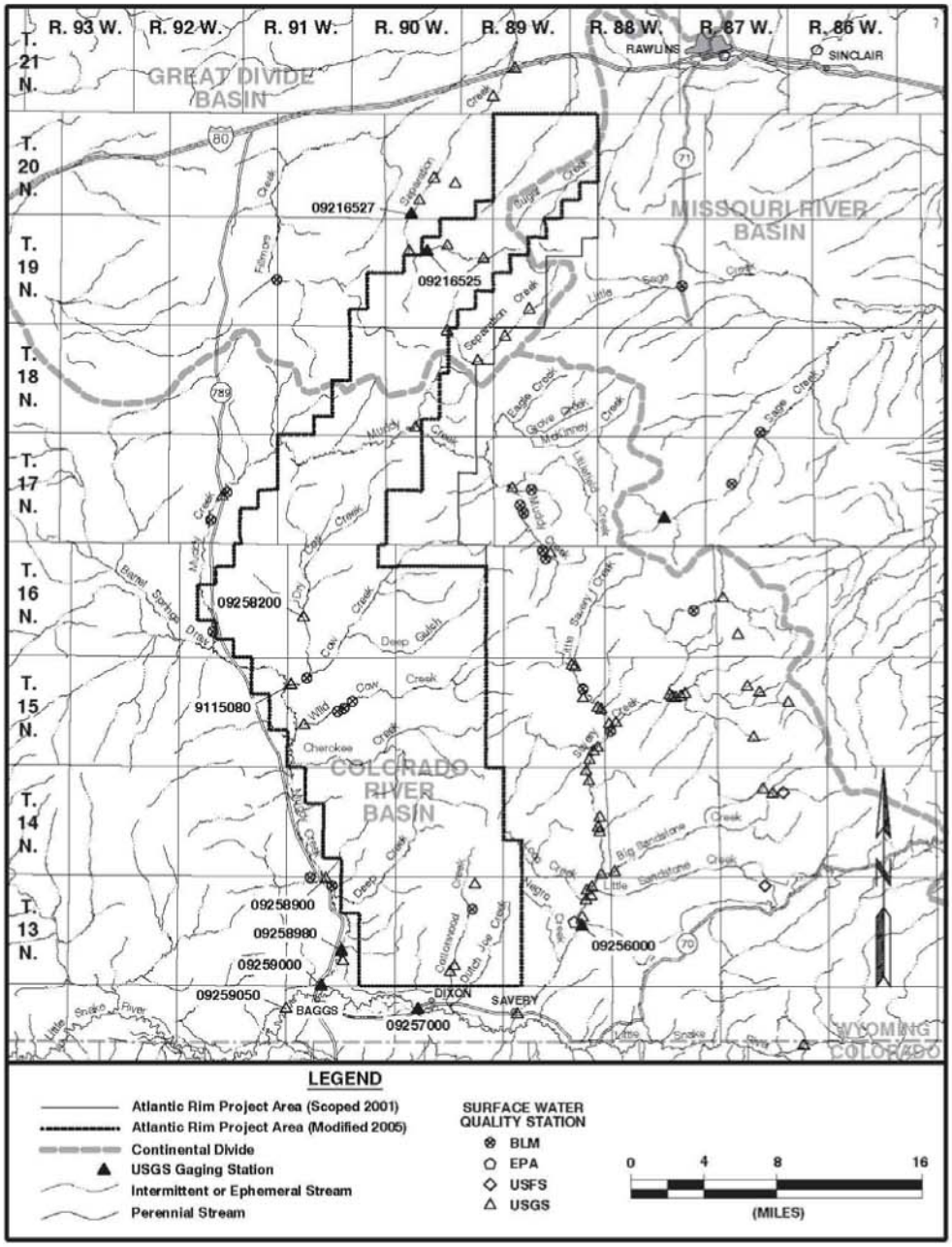
Surface Waters and Monitoring Stations



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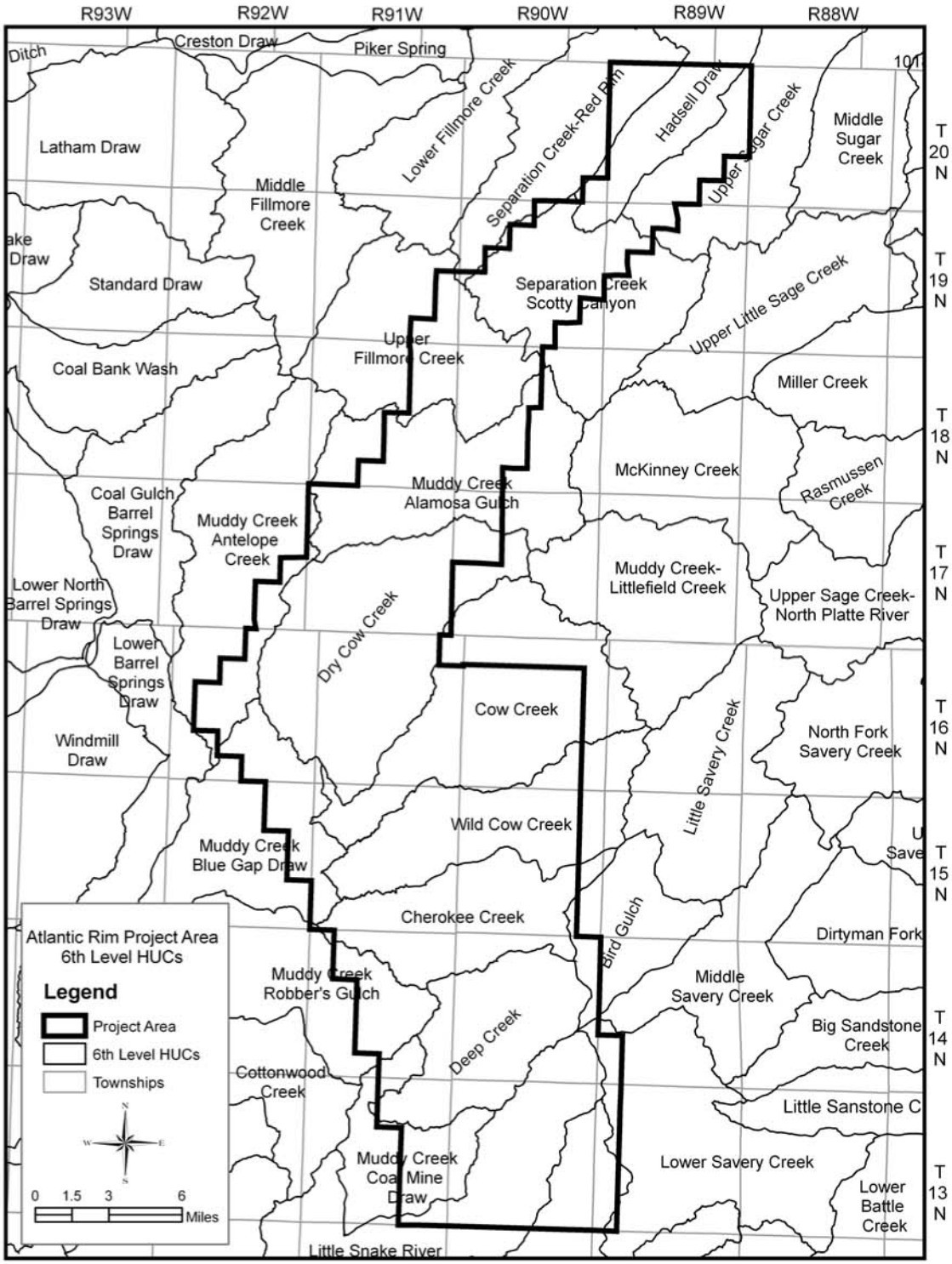
Hydrologic Unit Code Boundaries



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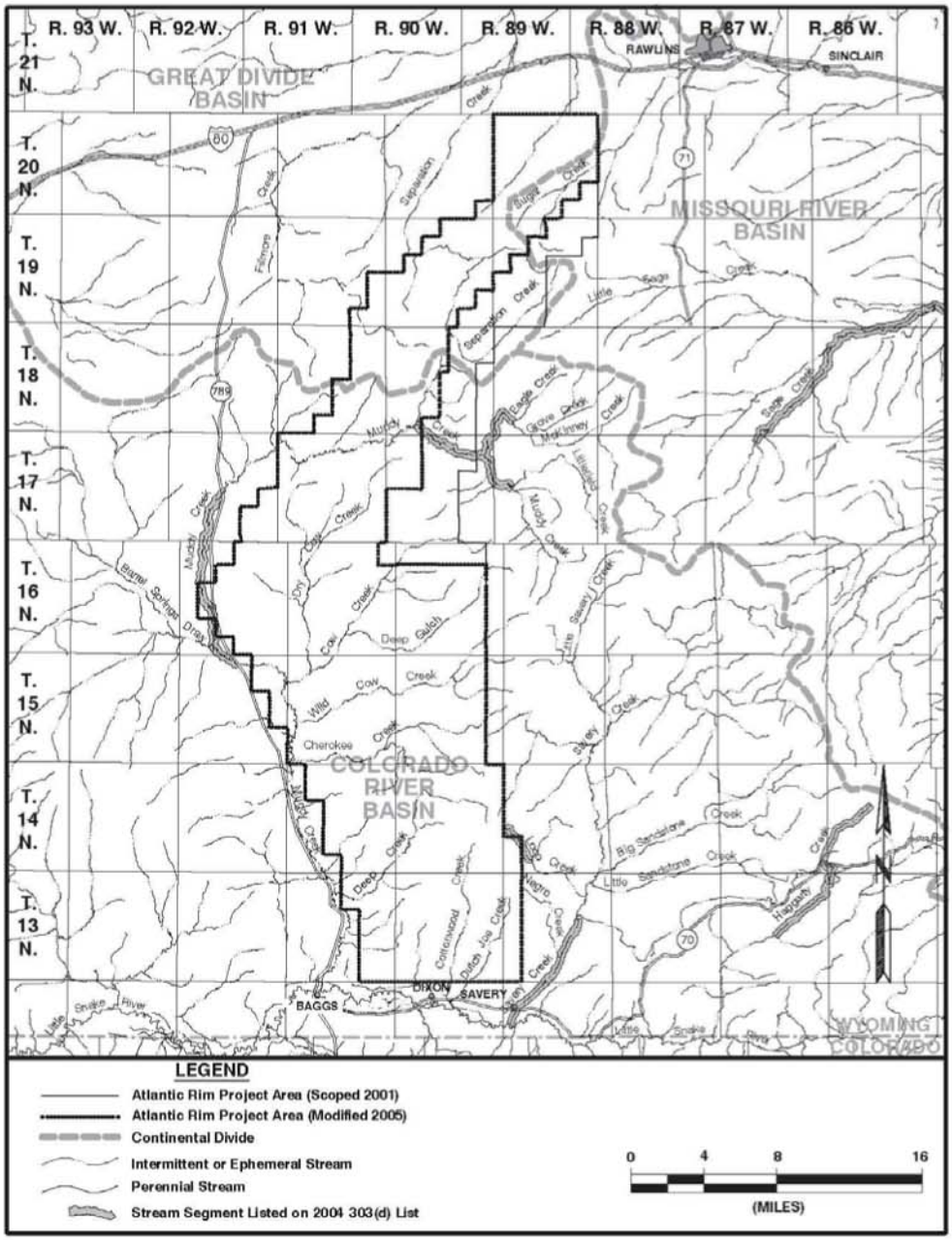
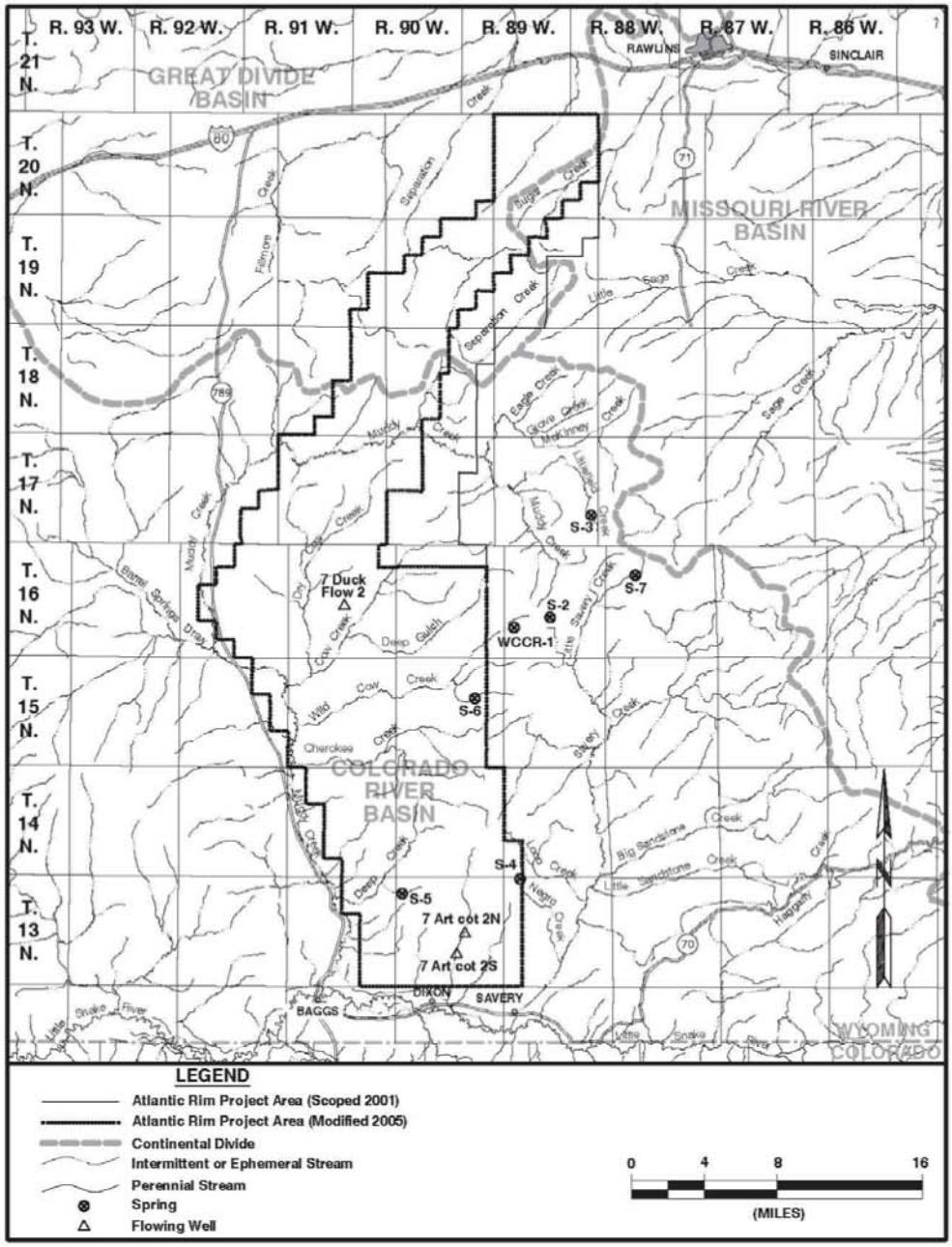
Threatened or Impaired Streams



ATLANTIC RIM DRAFT EIS MAP
Sampled Springs and Flowing Wells



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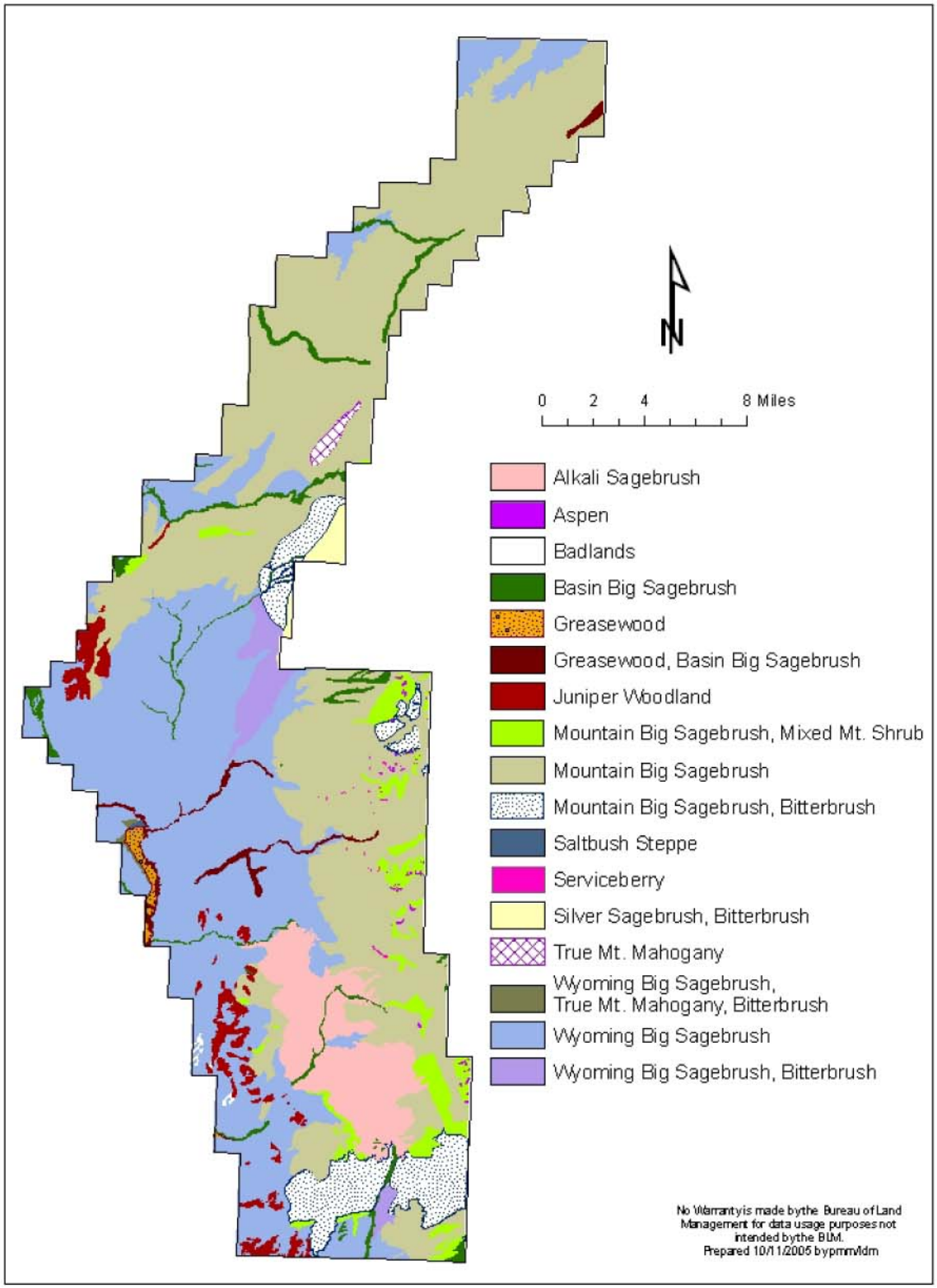
Vegetation Communities



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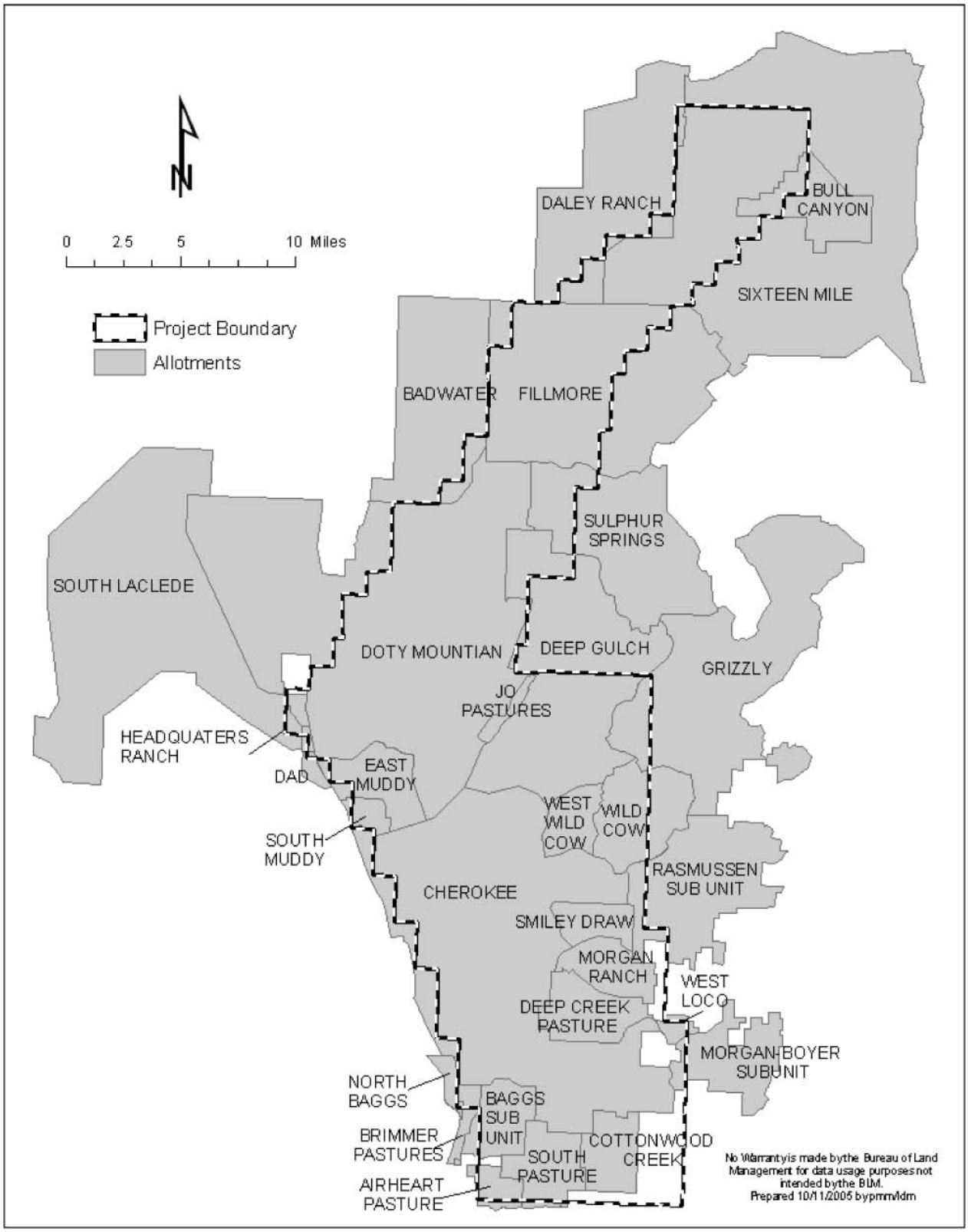
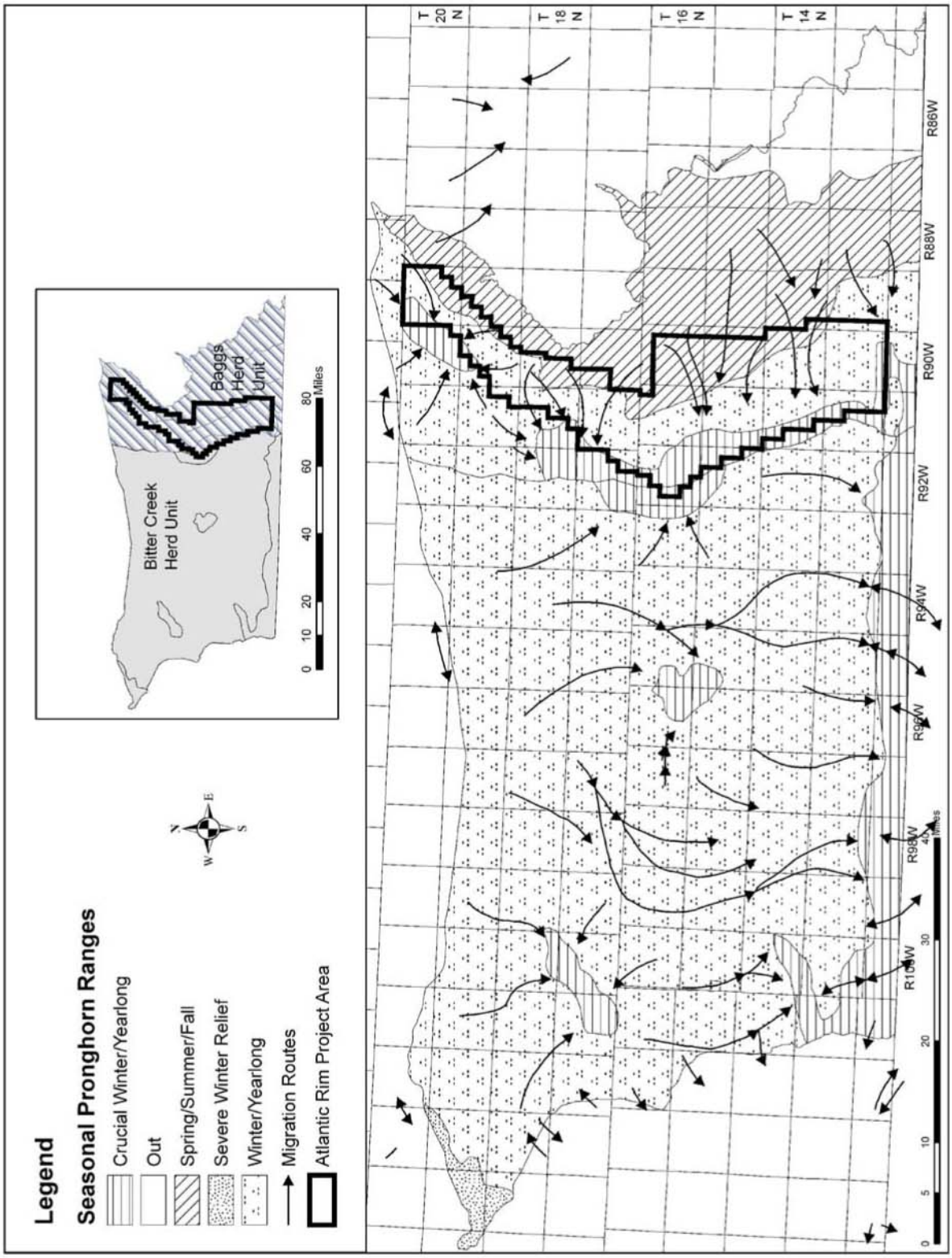
Grazing Allotments



ATLANTIC RIM DRAFT EIS MAP
Seasonal Pronghorn Ranges and Migrations Routes



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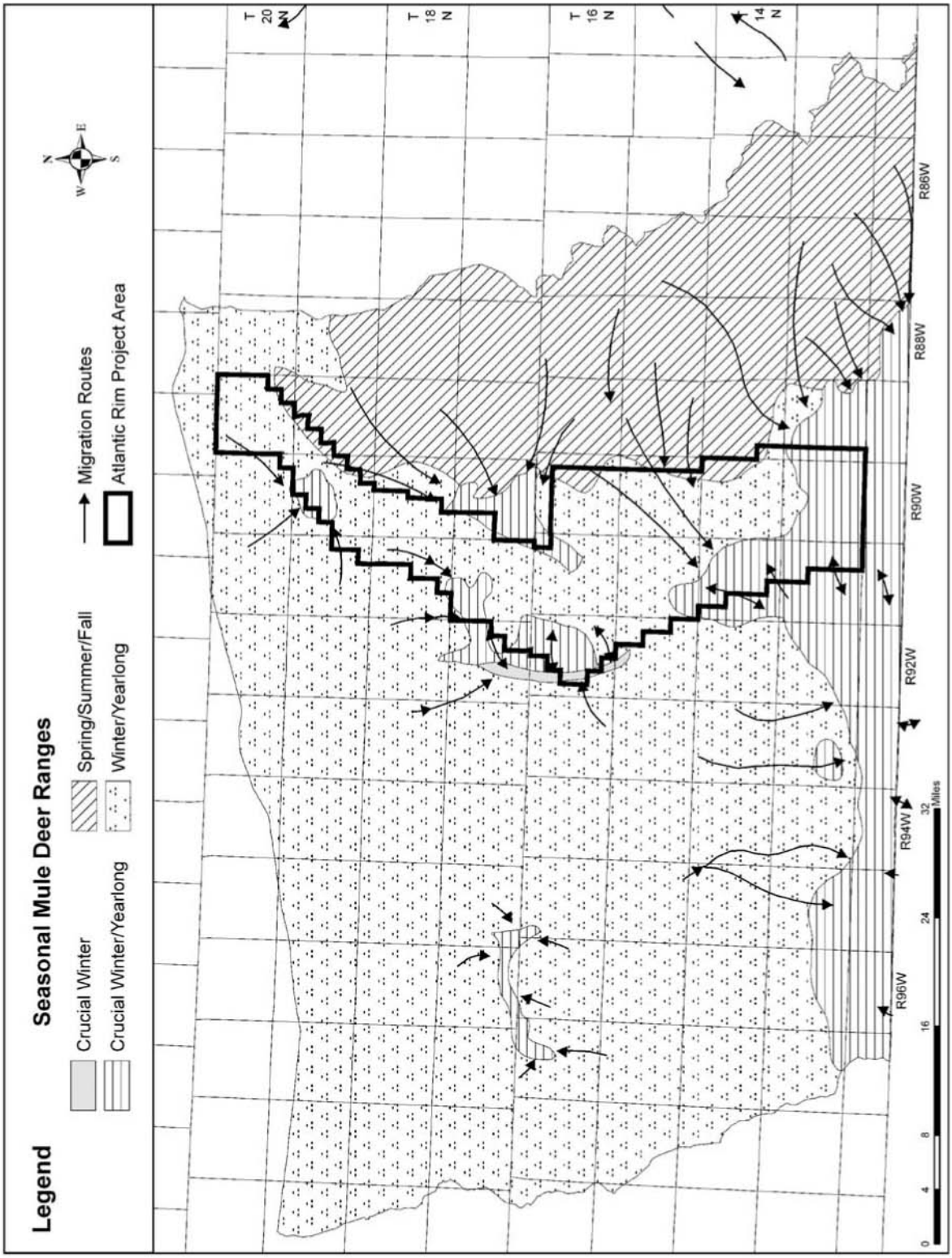
Seasonal Mule Deer Ranges and Migrations Routes



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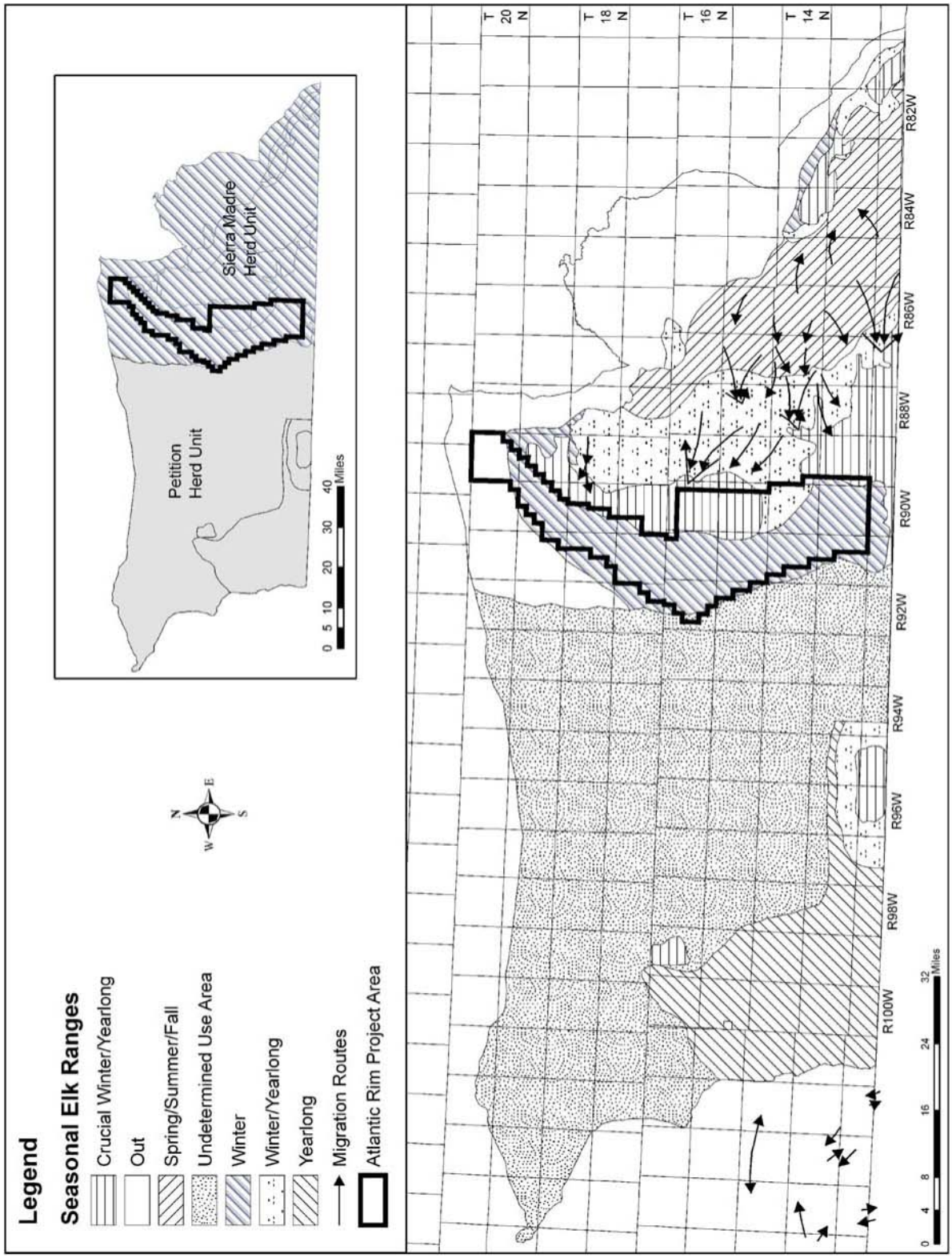
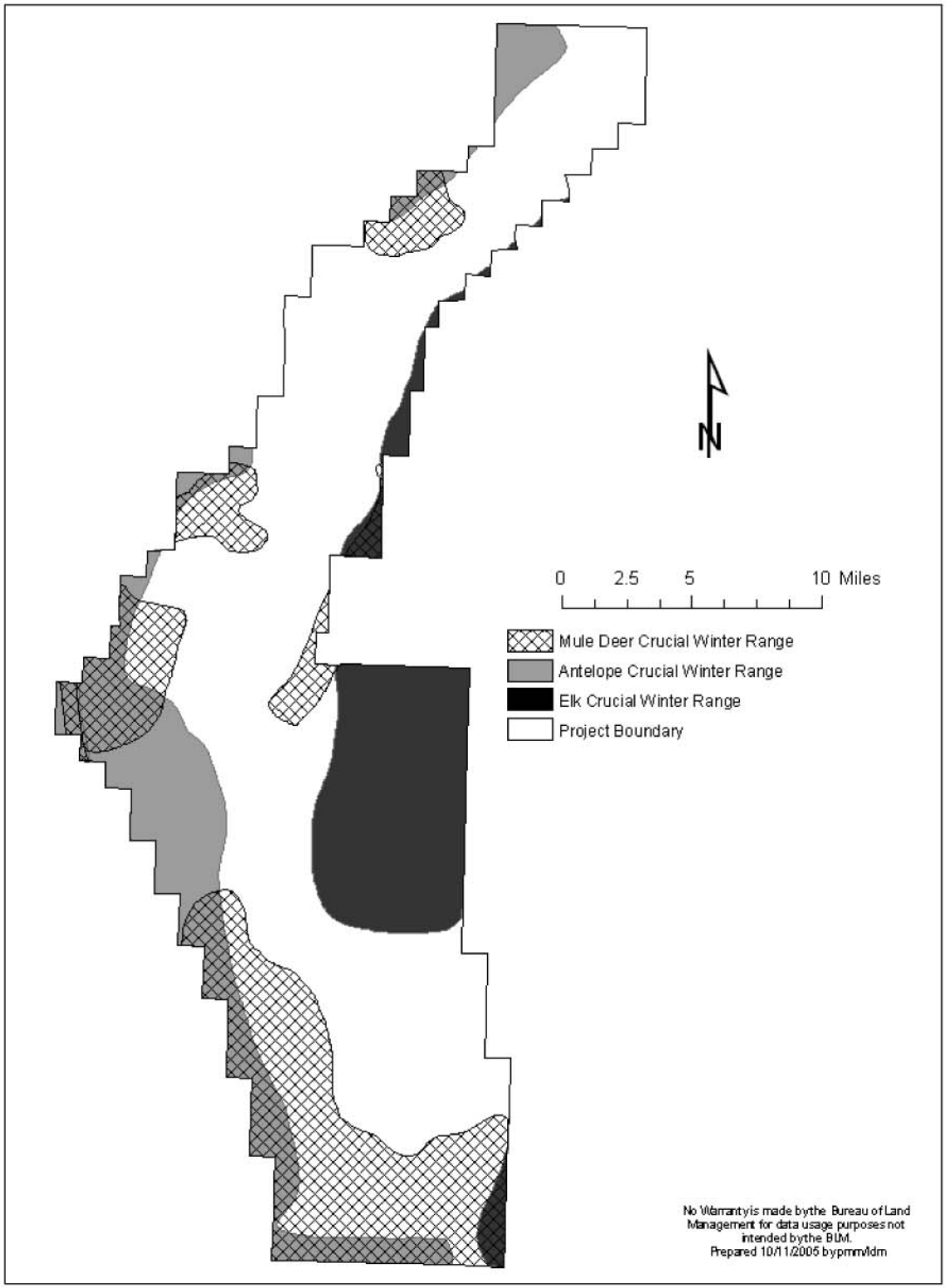
Seasonal Elk Ranges and Migrations Routes

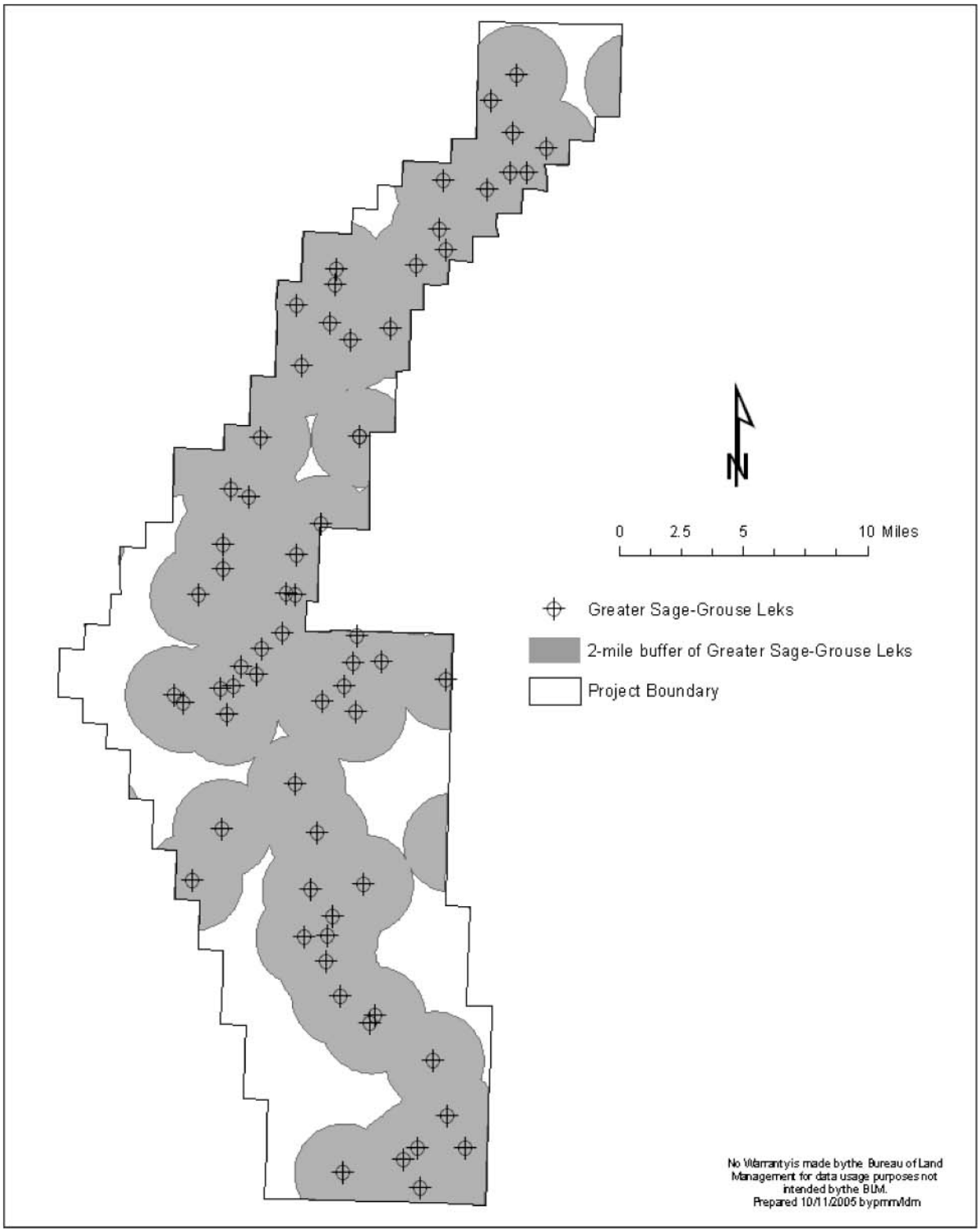


ATLANTIC RIM DRAFT EIS MAP
Big Game Crucial Winter Ranges

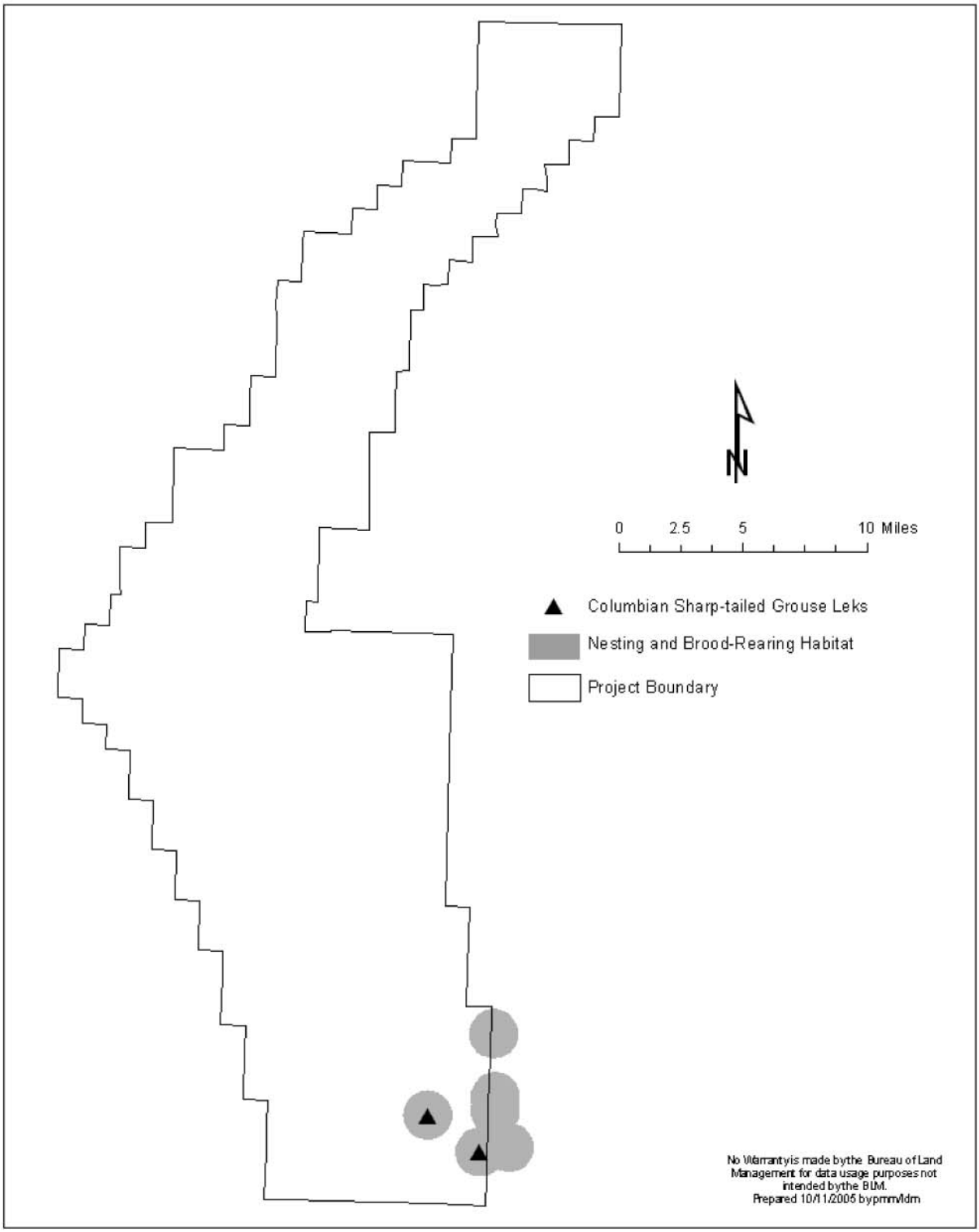


ATLANTIC RIM DRAFT EIS
Overlapping Crucial Winter Ranges

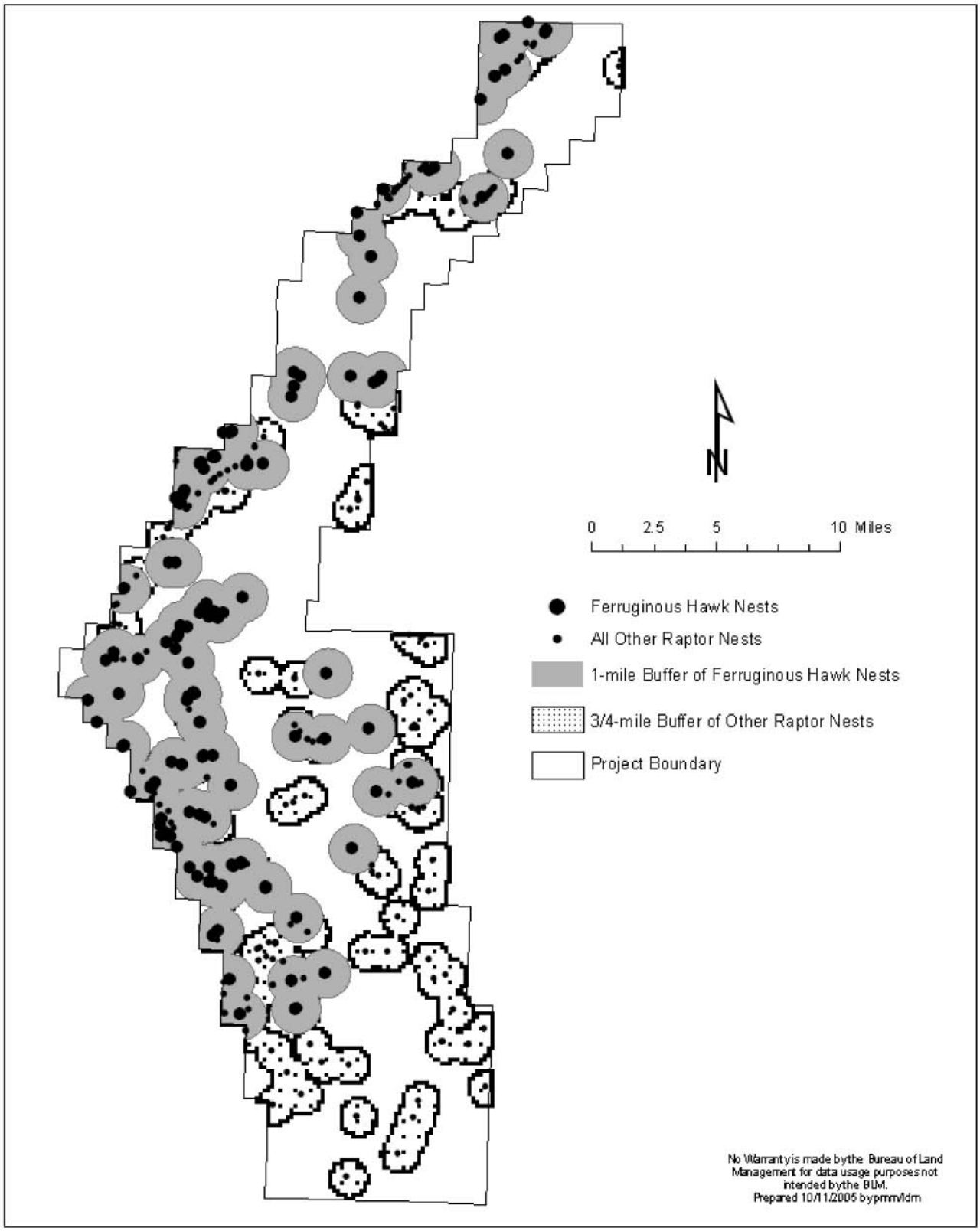
ATLANTIC RIM DRAFT EIS
Greater Sage-Grouse Leks



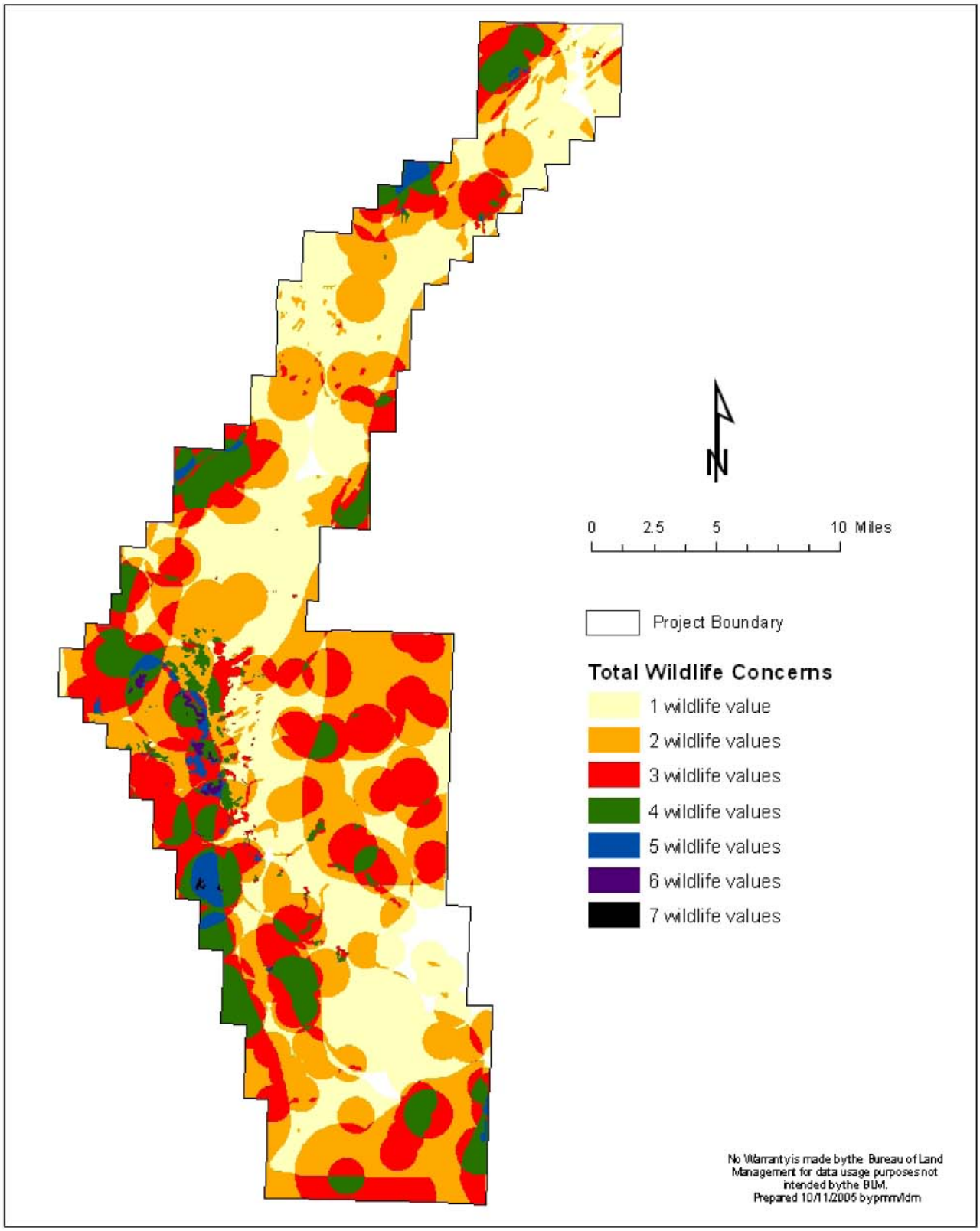
ATLANTIC RIM DRAFT EIS
Columbian Sharp-tailed Grouse Leks Nesting and Brood-Rearing Habitat



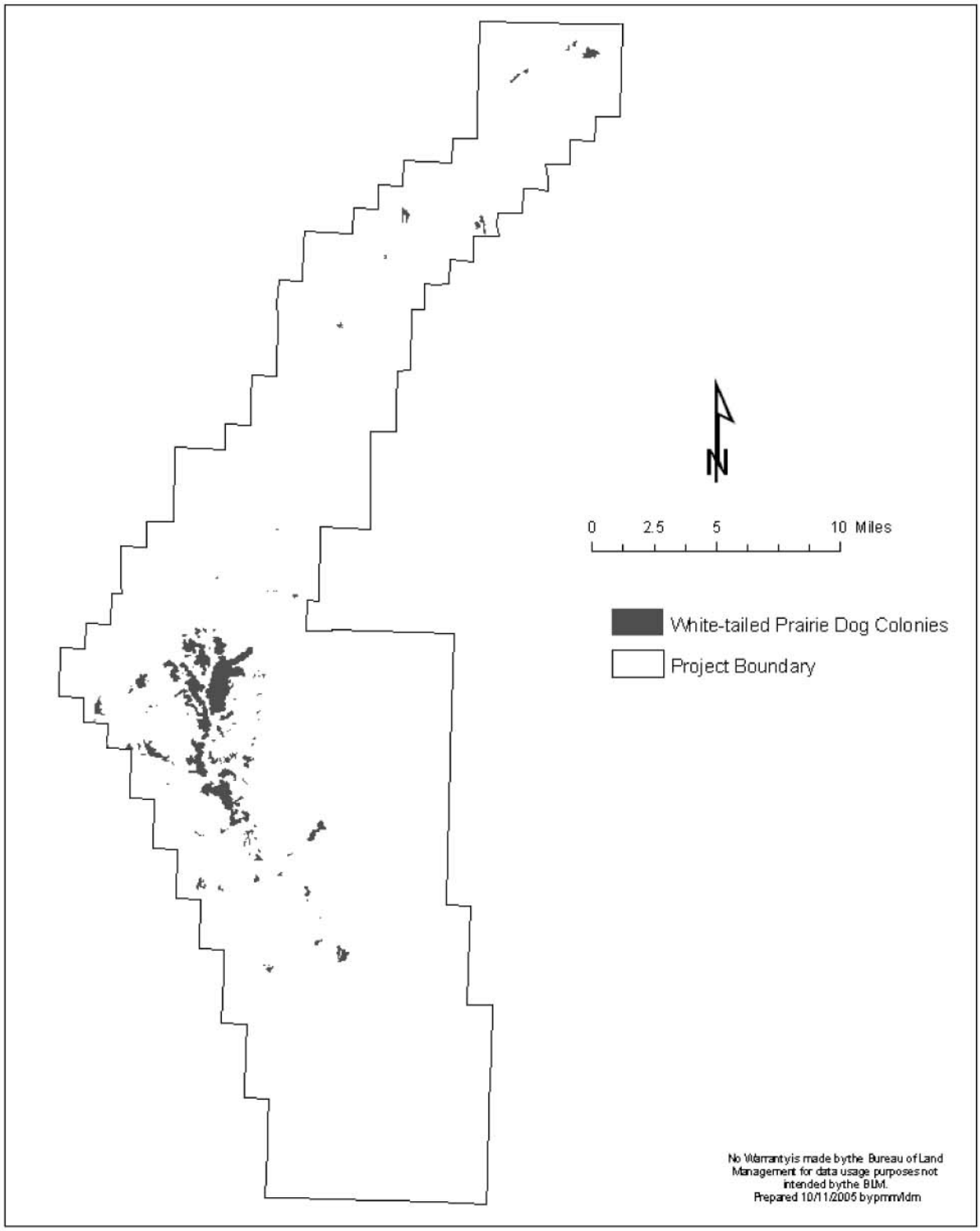
ATLANTIC RIM DRAFT EIS
Raptor Nest Locations

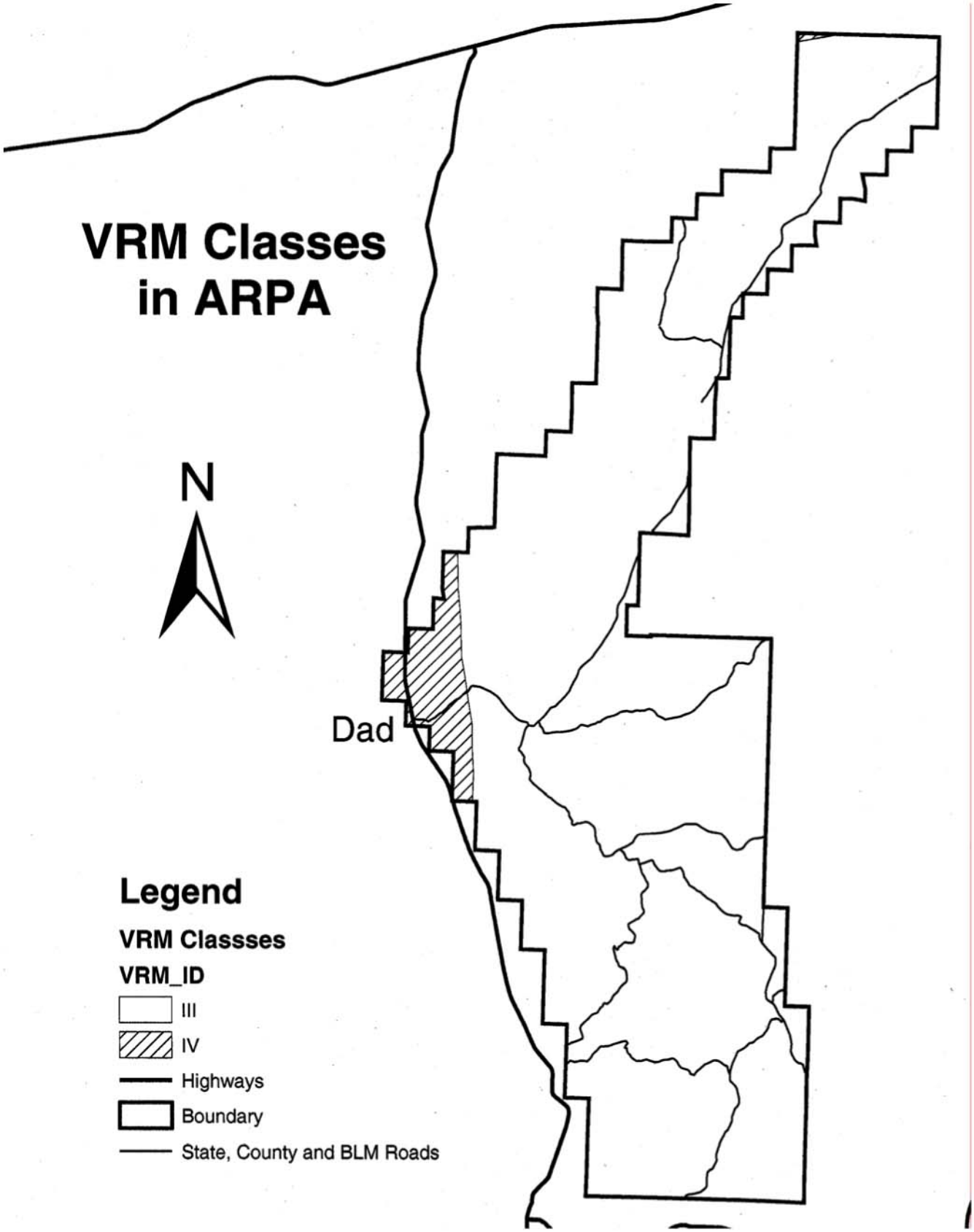


ATLANTIC RIM DRAFT EIS
Overlapping Wildlife Concerns

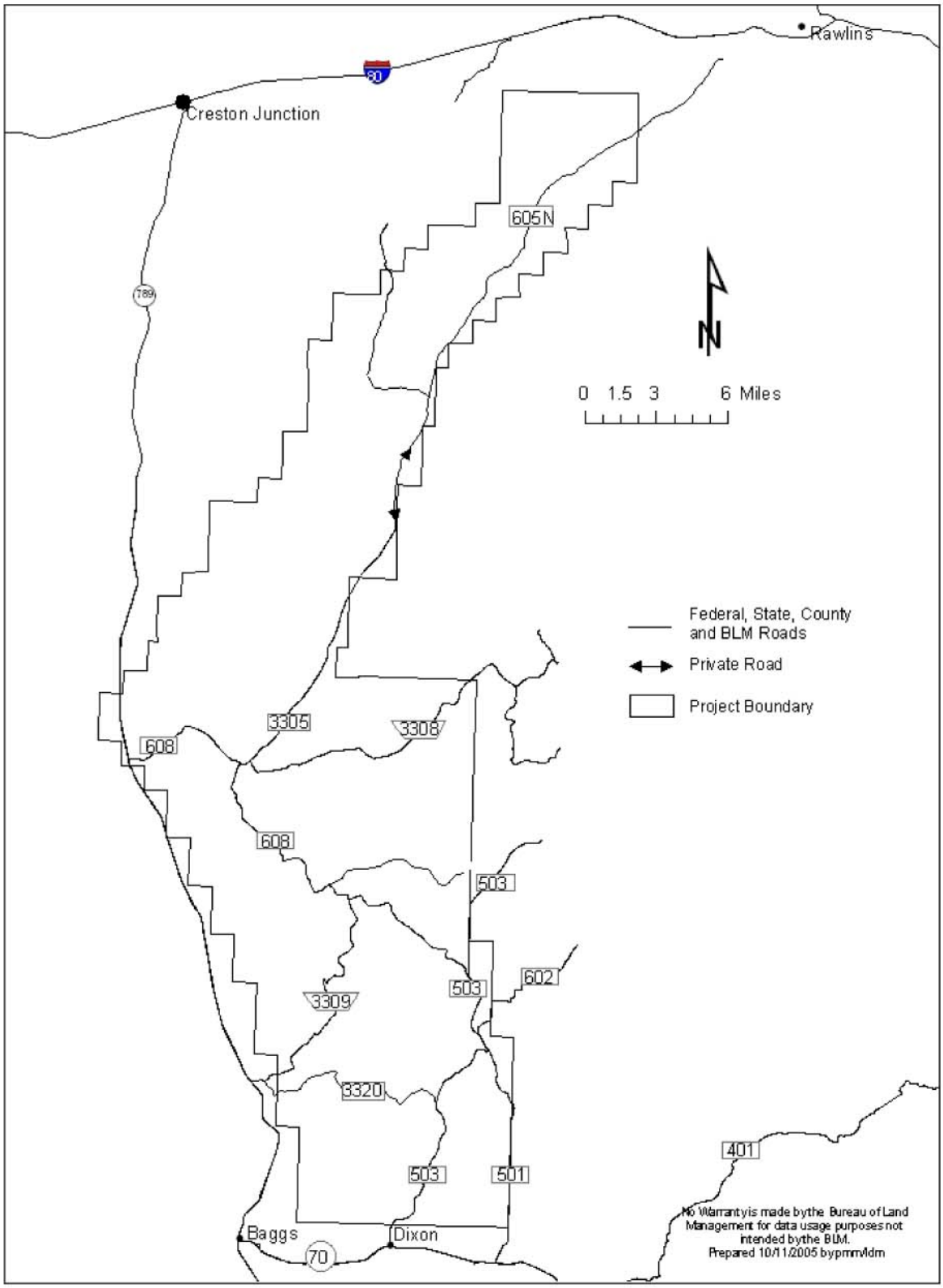


ATLANTIC RIM DRAFT EIS
White-Tailed Prairie Dog Colonies

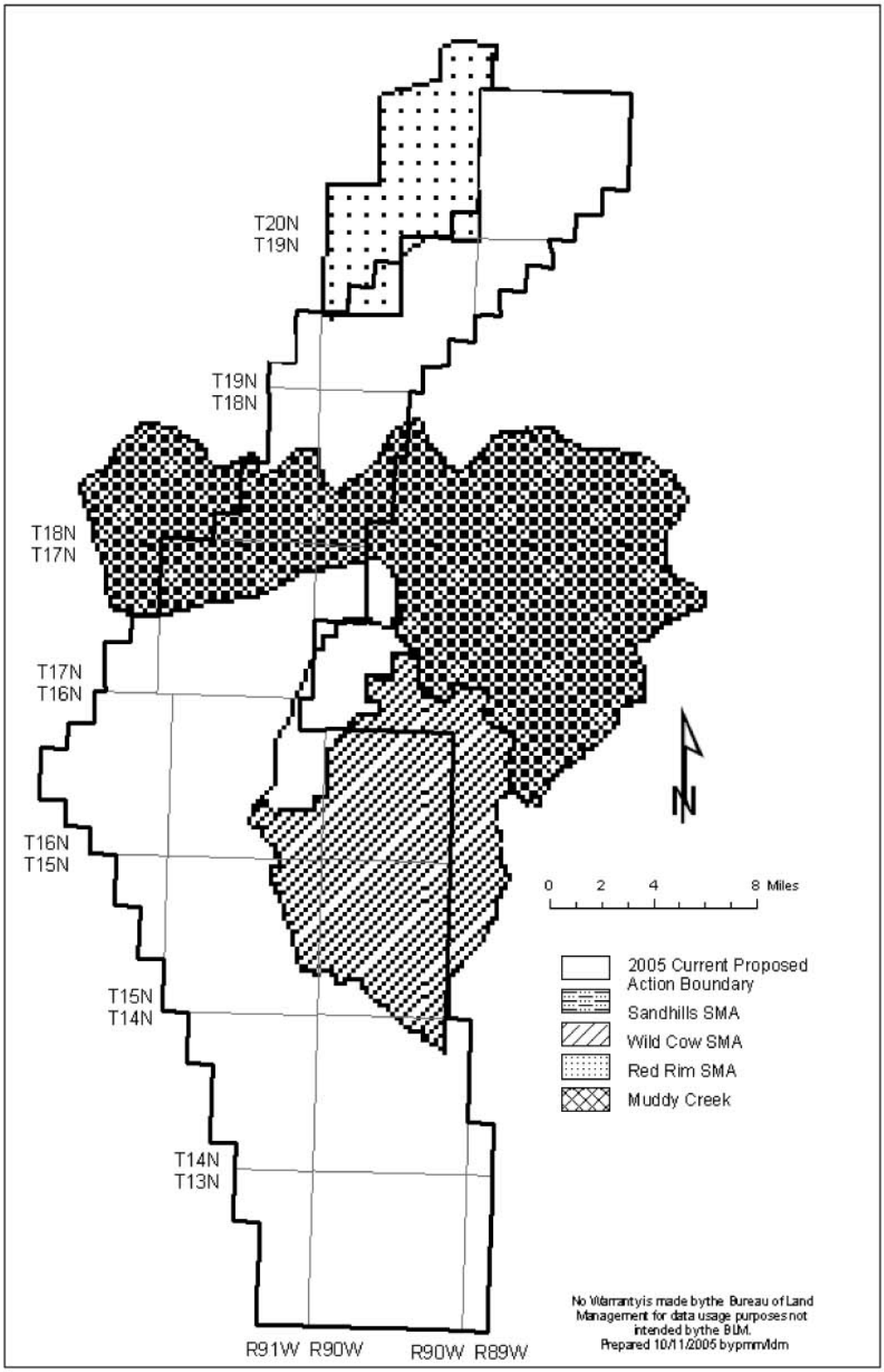



VRM Classes
in ARPA
N
Dad
Legend
VRM Classses
VRM_ID
III
IV
Highways
Boundary
State, County and BLM Roads

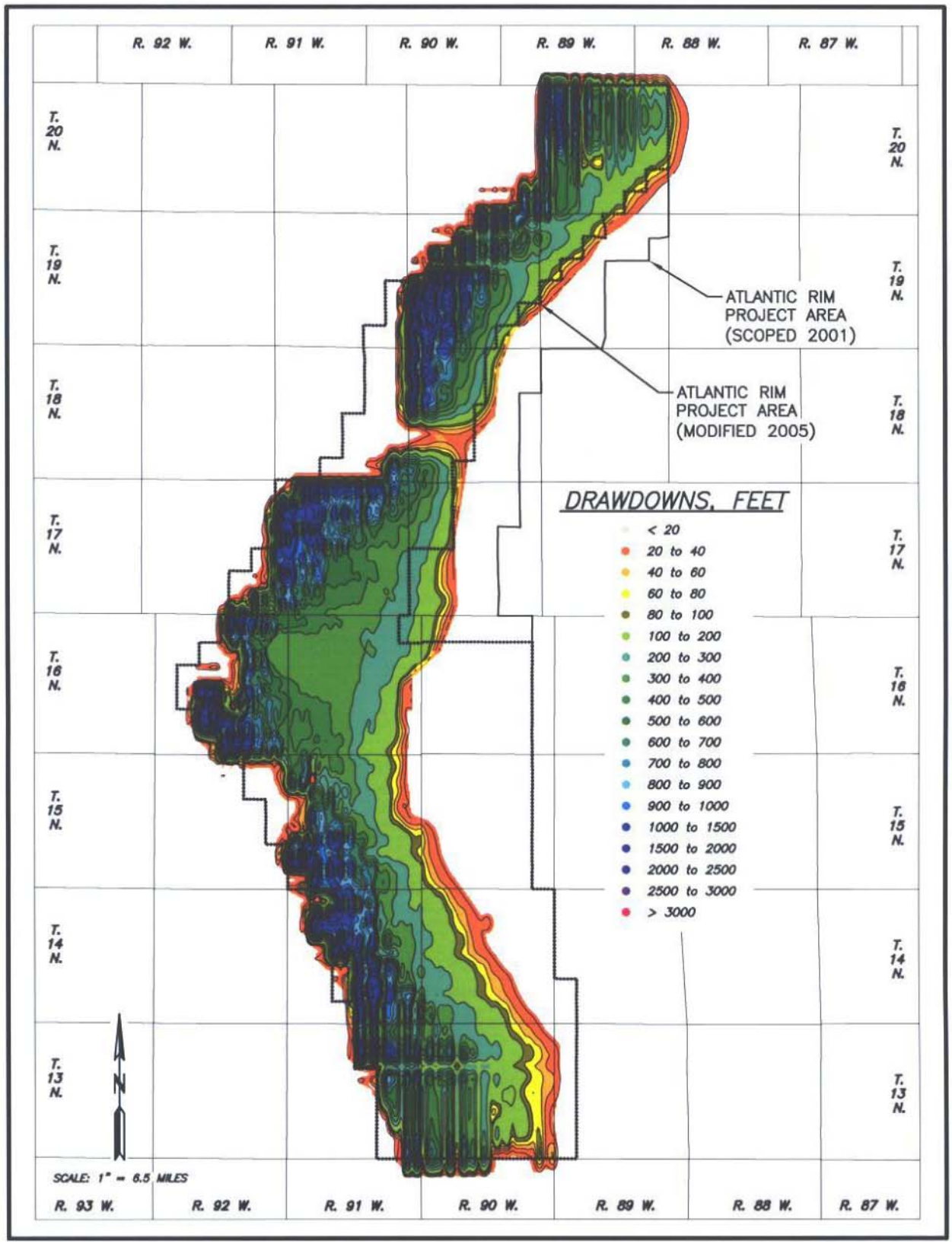
ATLANTIC RIM DRAFT EIS MAP
Federal, State, County, and BLM Roads



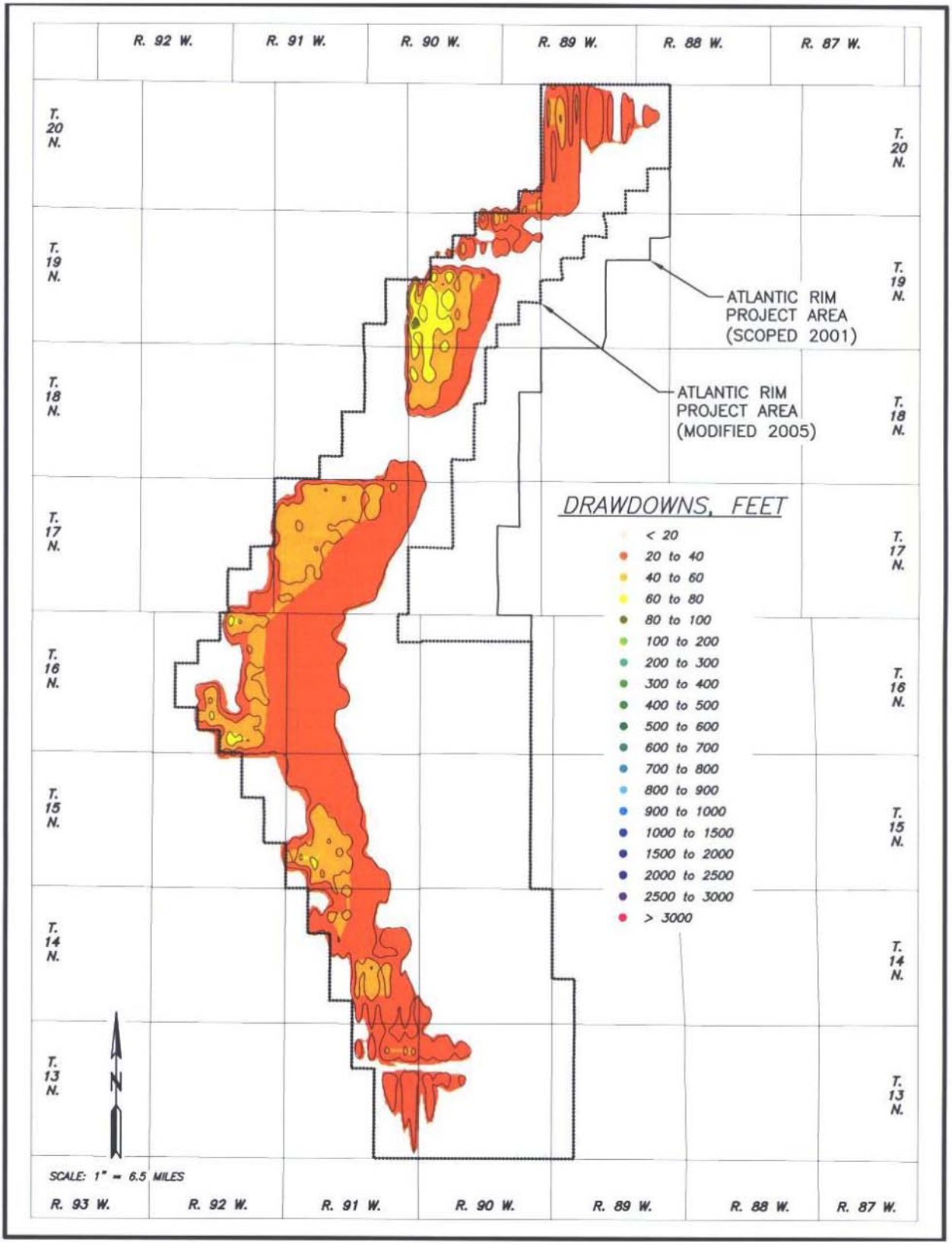
ATLANTIC RIM DRAFT EIS
Special Management Areas Overview



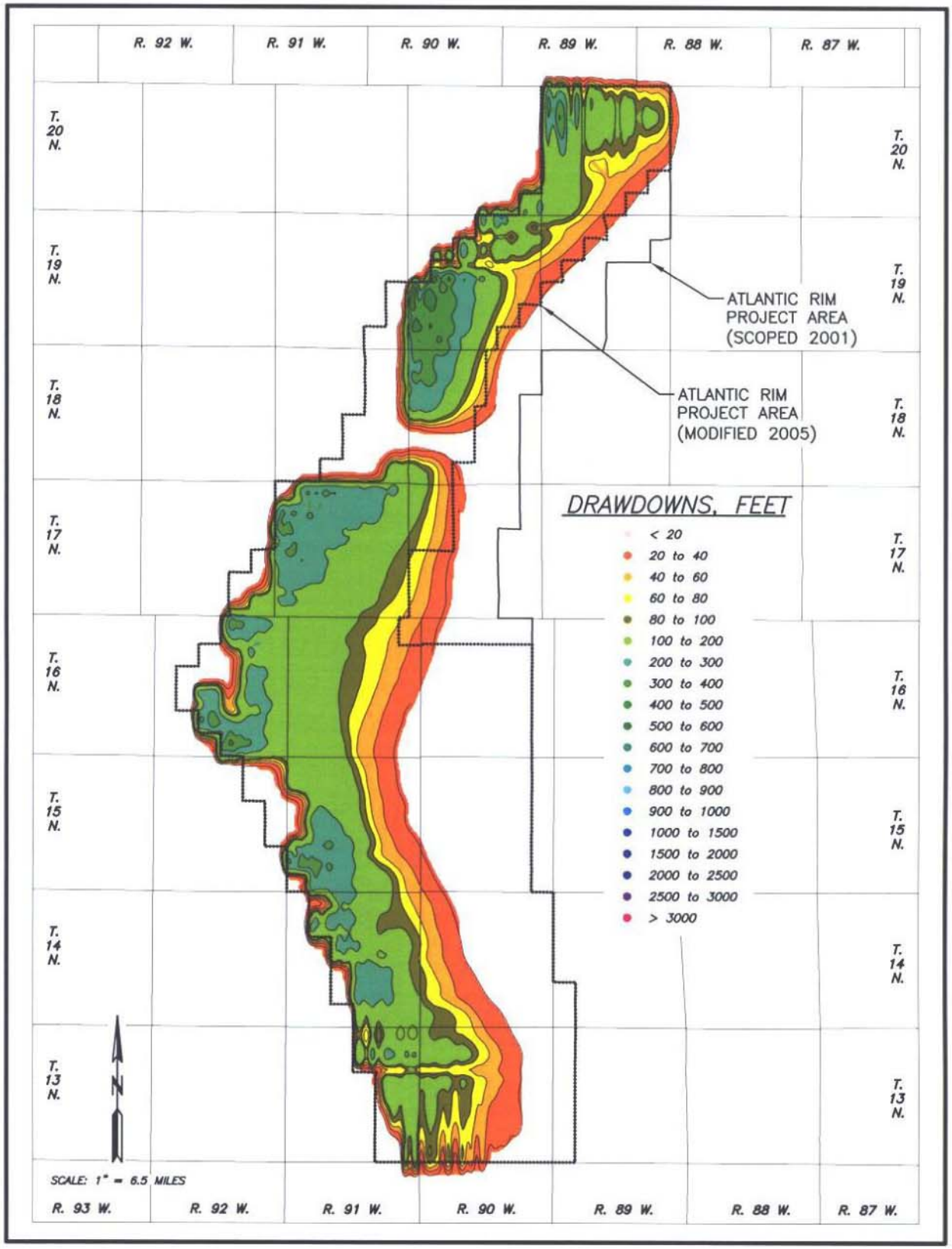
ATLANTIC RIM DRAFT EIS MAP
Drawdowns within Layer 3 for Year 2030



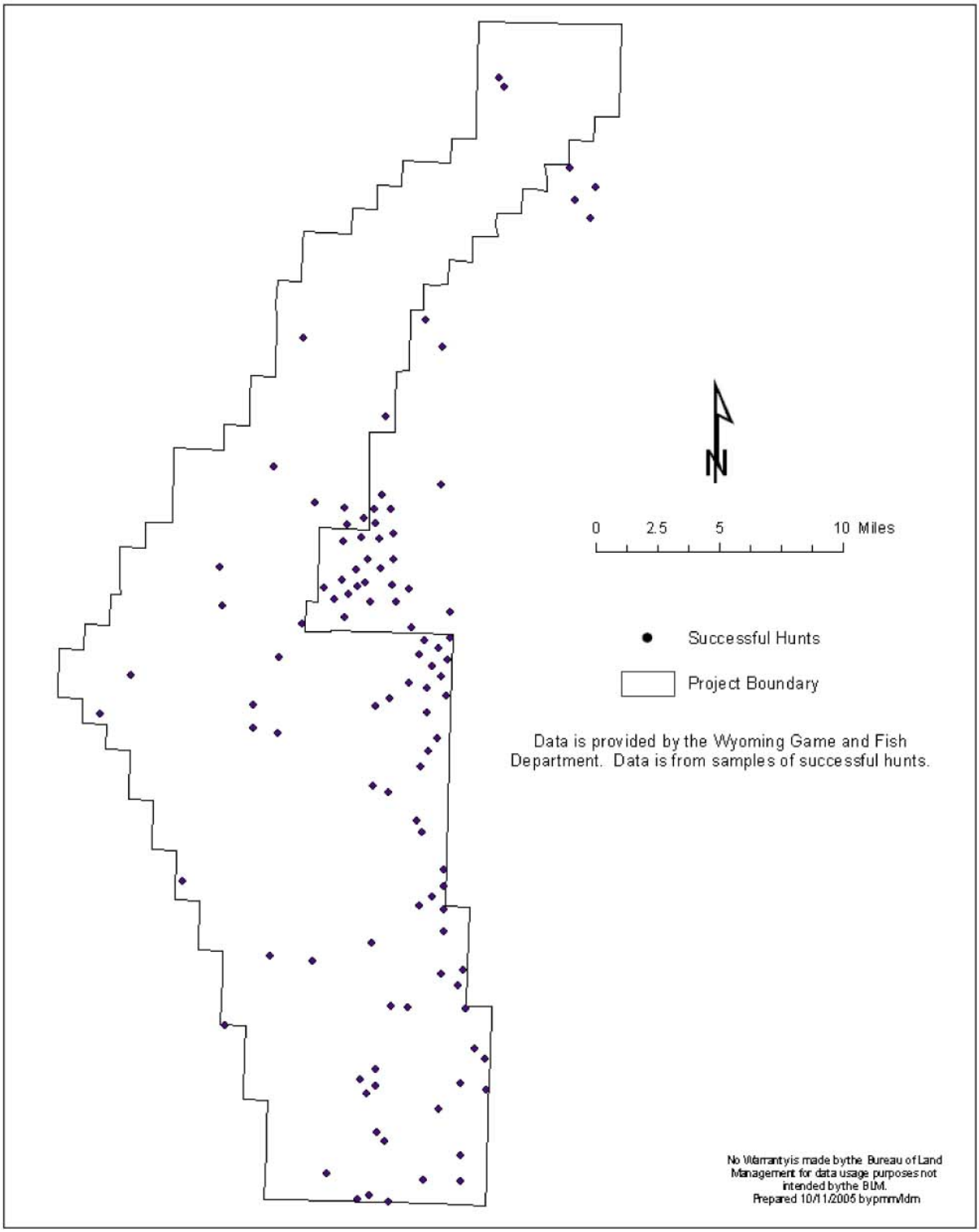
ATLANTIC RIM DRAFT EIS MAP
Drawdowns within Layer 1 for Year 2030



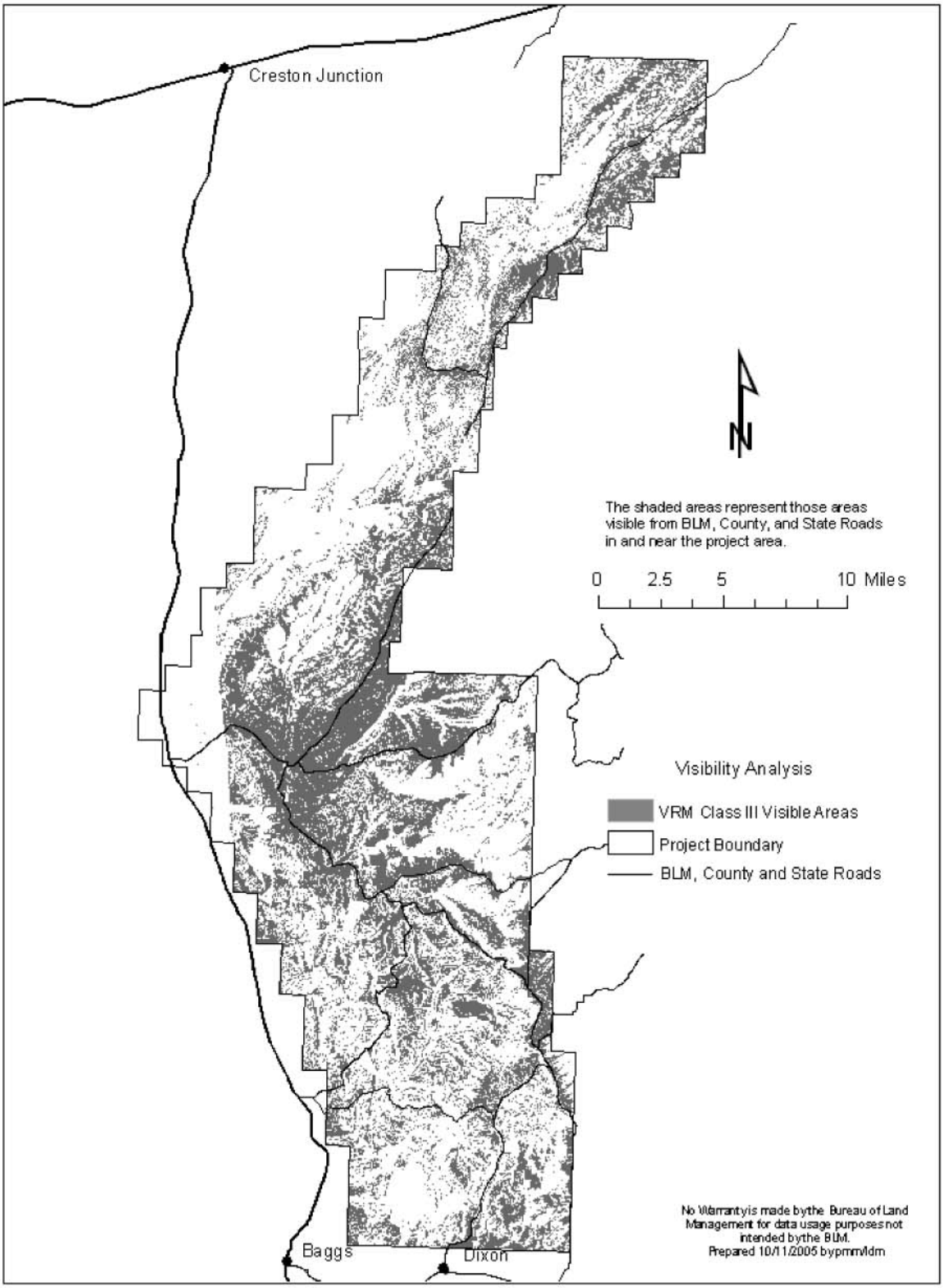
ATLANTIC RIM DRAFT EIS MAP
Drawdowns within Layer 5 for Year 2030



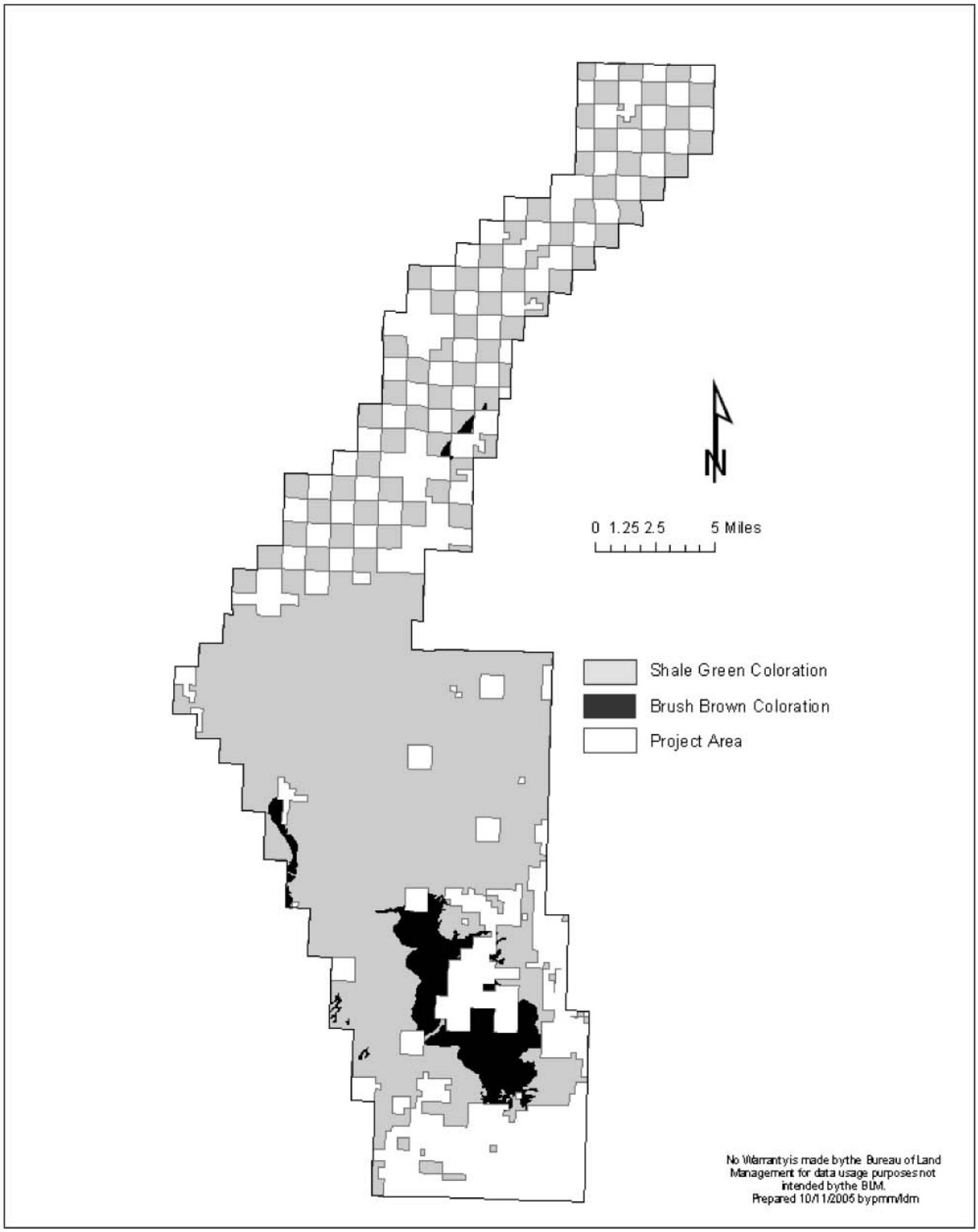
ATLANTIC RIM DRAFT EIS
Locations of Successful Hunts



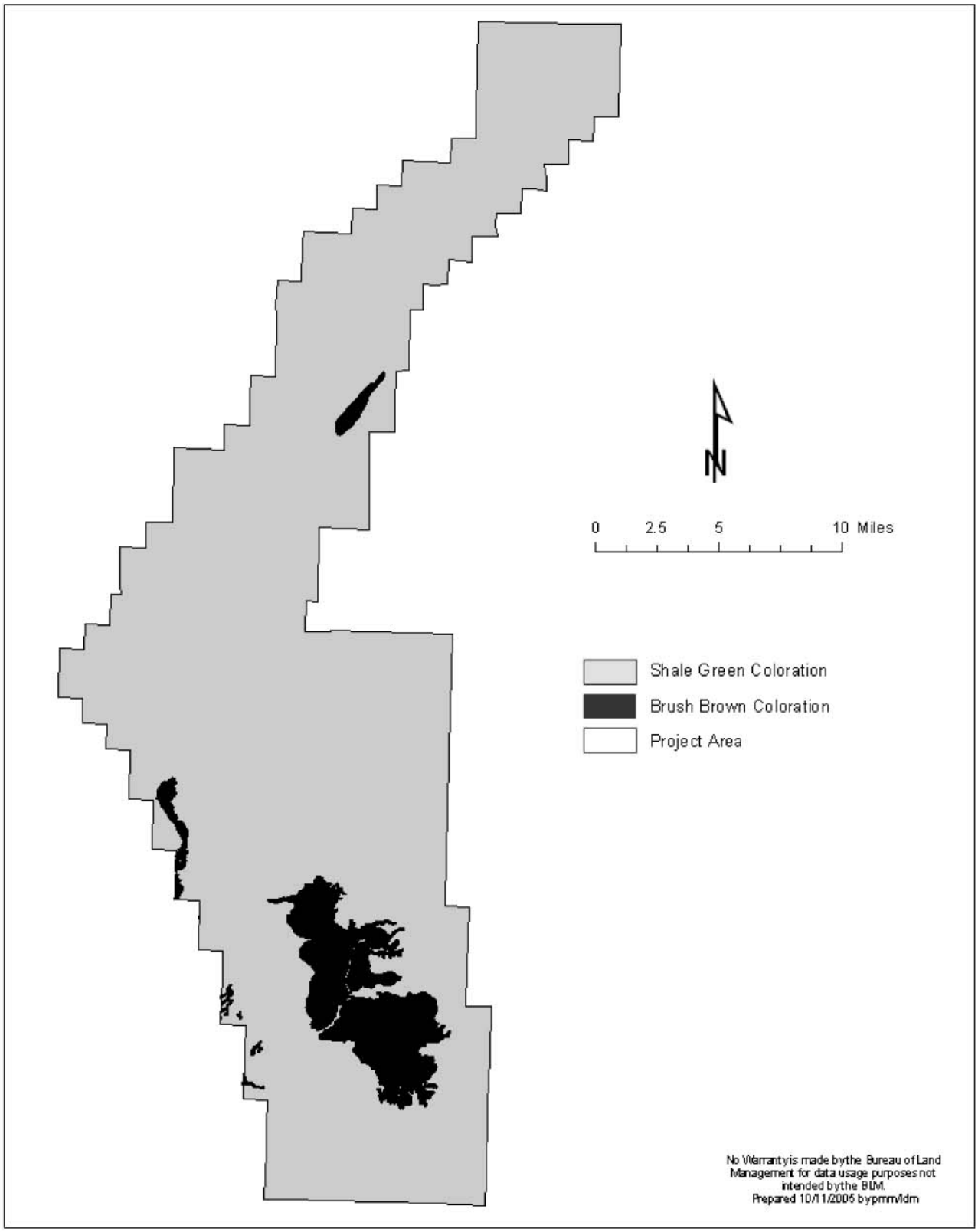
ATLANTIC RIM DRAFT EIS MAP
Areas Visible from Main Roads in VRM Class III with slopes <5%



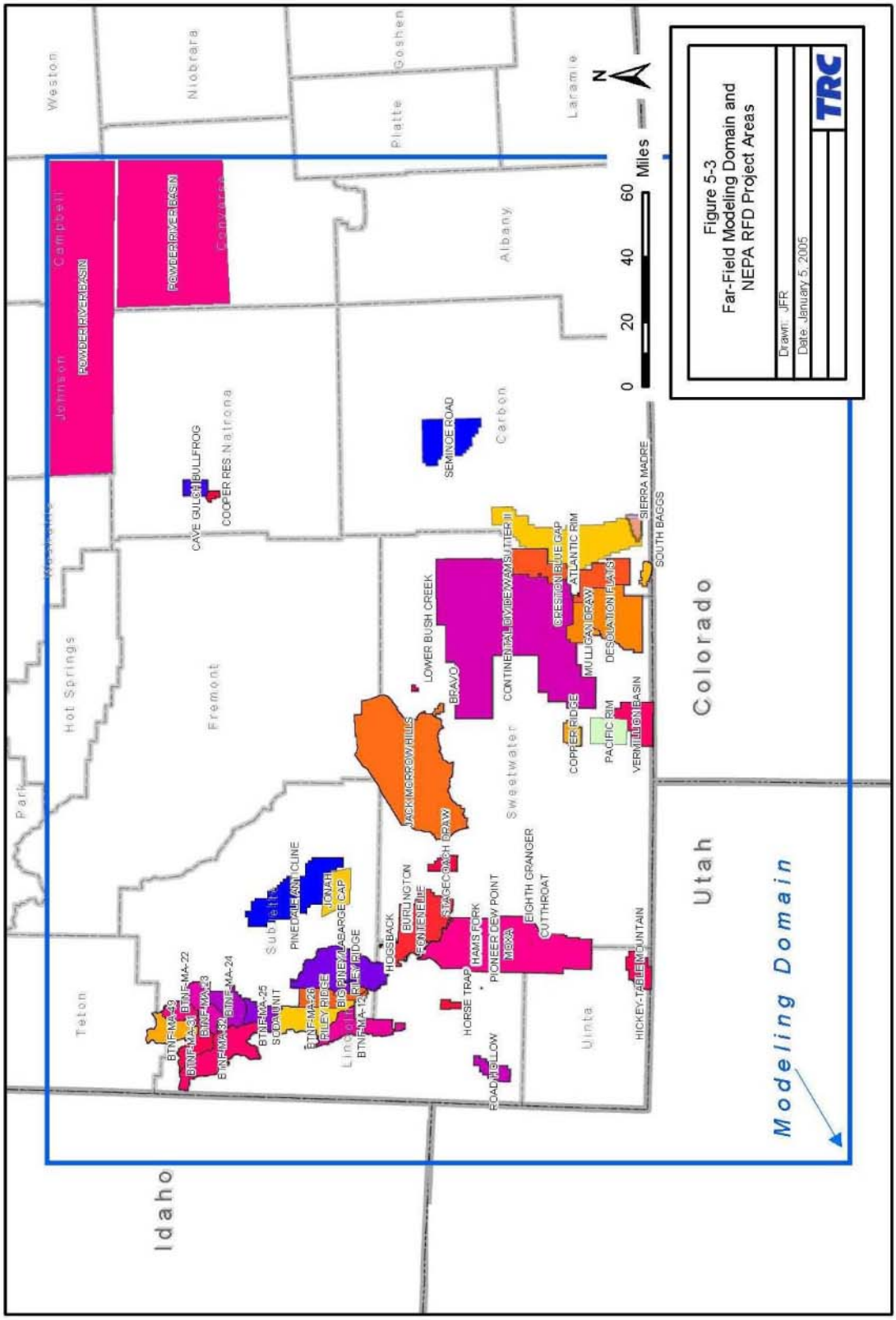
ATLANTIC RIM DRAFT EIS
Project Area Facility Coloration for Federal Lands



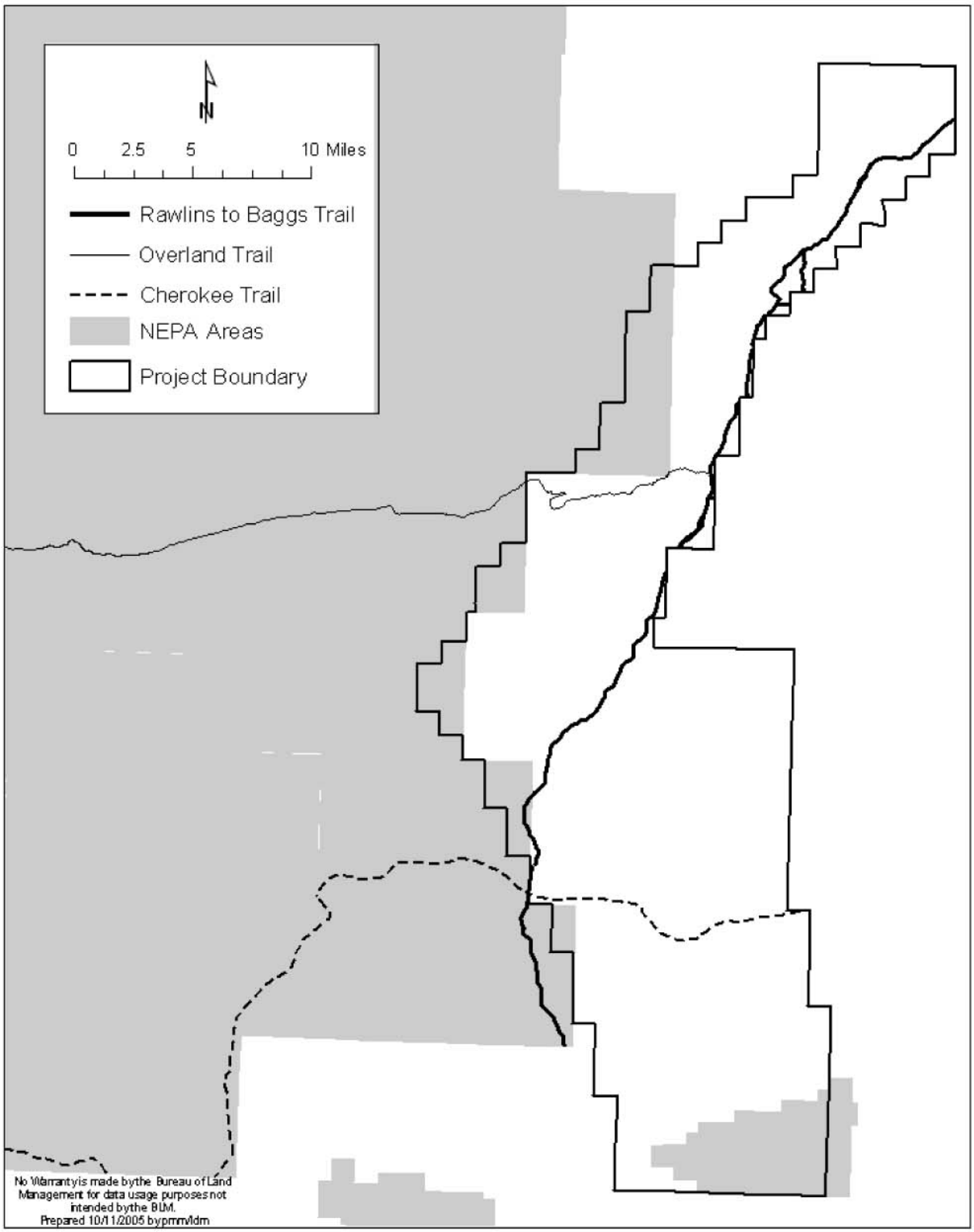
ATLANTIC RIM DRAFT EIS
Project Area Facility Coloration



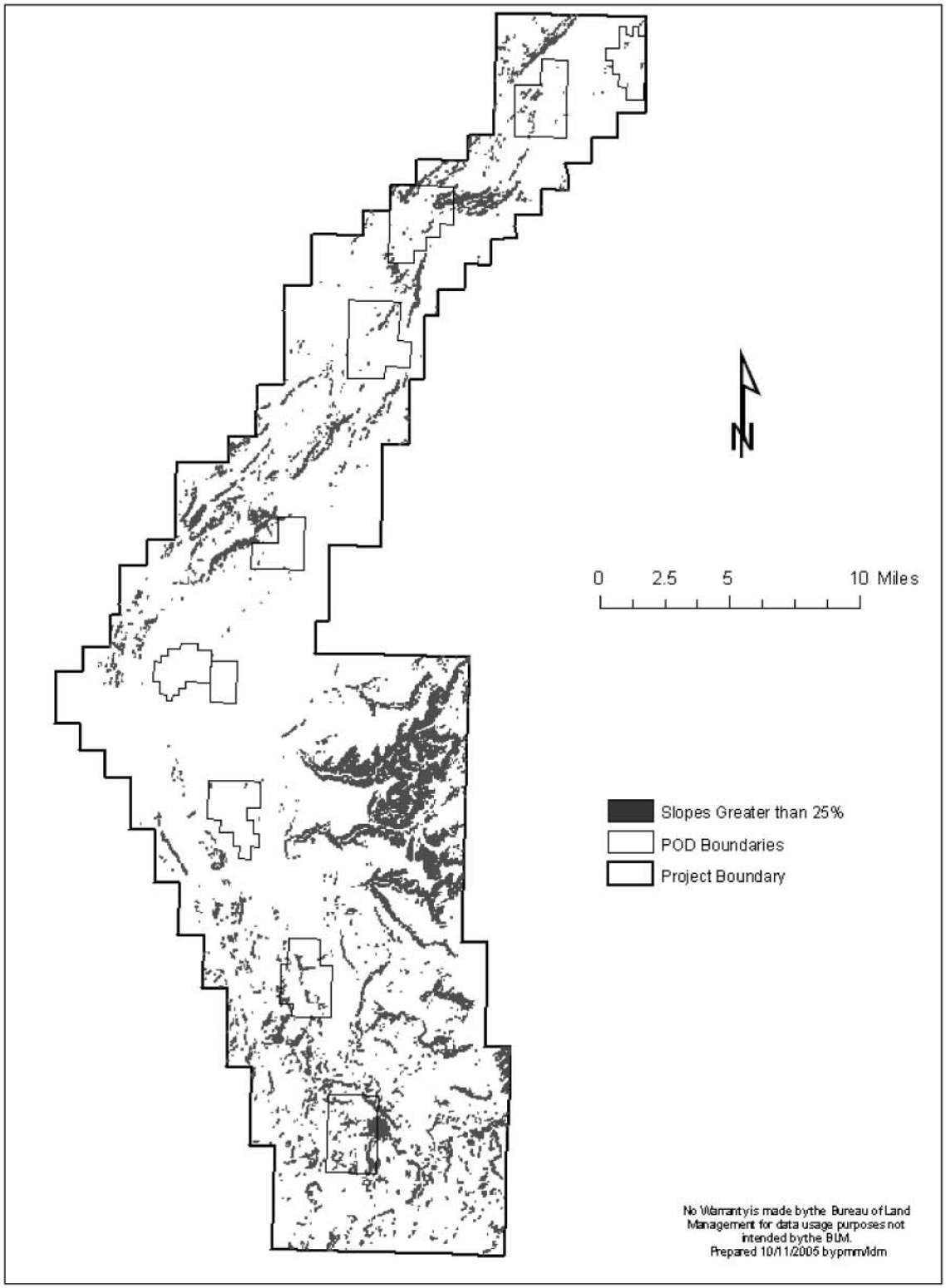
ATLANTIC RIM DRAFT EIS MAP
Far-field Modeling Domain and NEPA RFD Project Areas



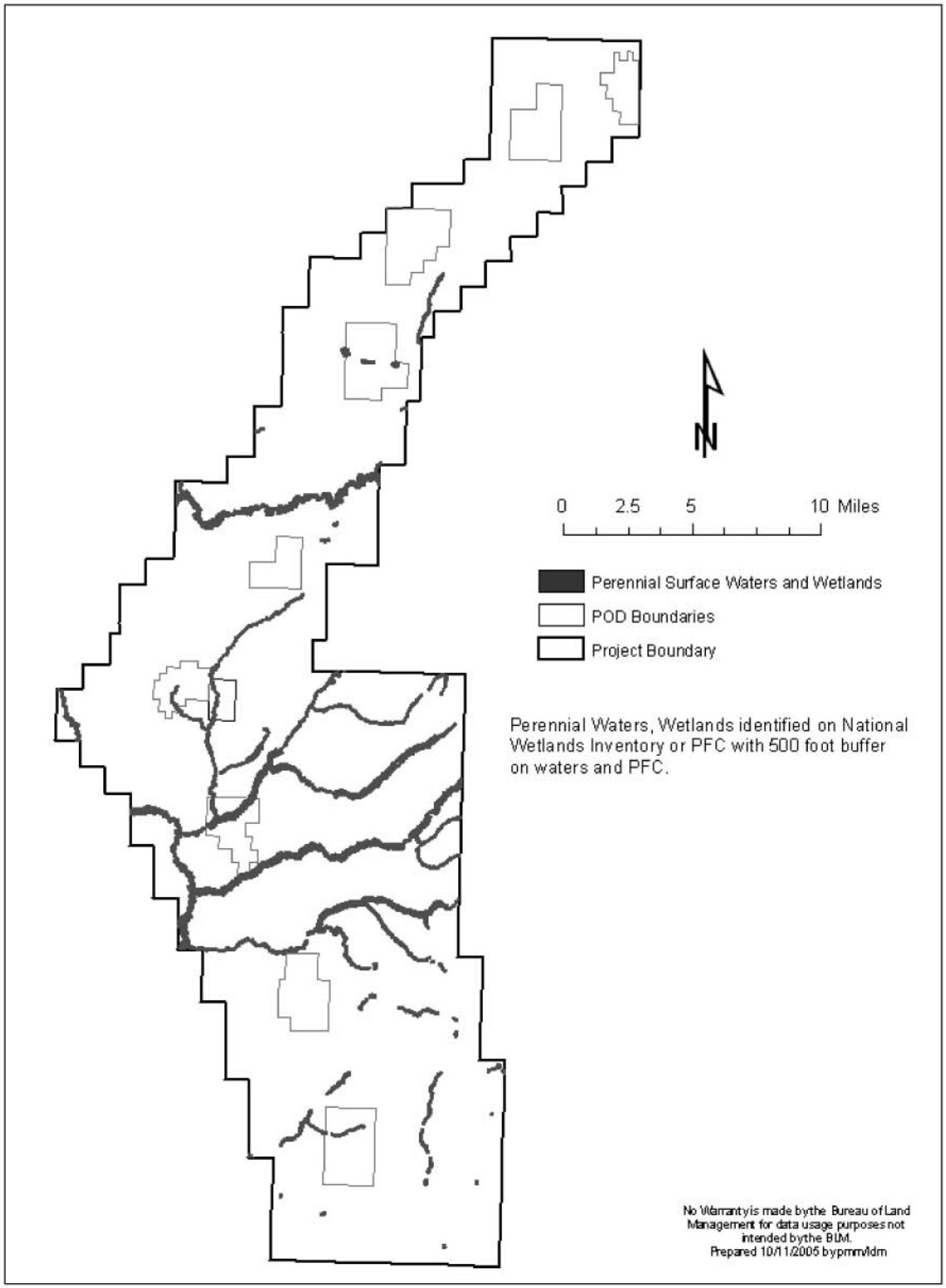
ATLANTIC RIM DRAFT EIS MAP
Chapter 5 - Cumulative Impacts Historic Trails



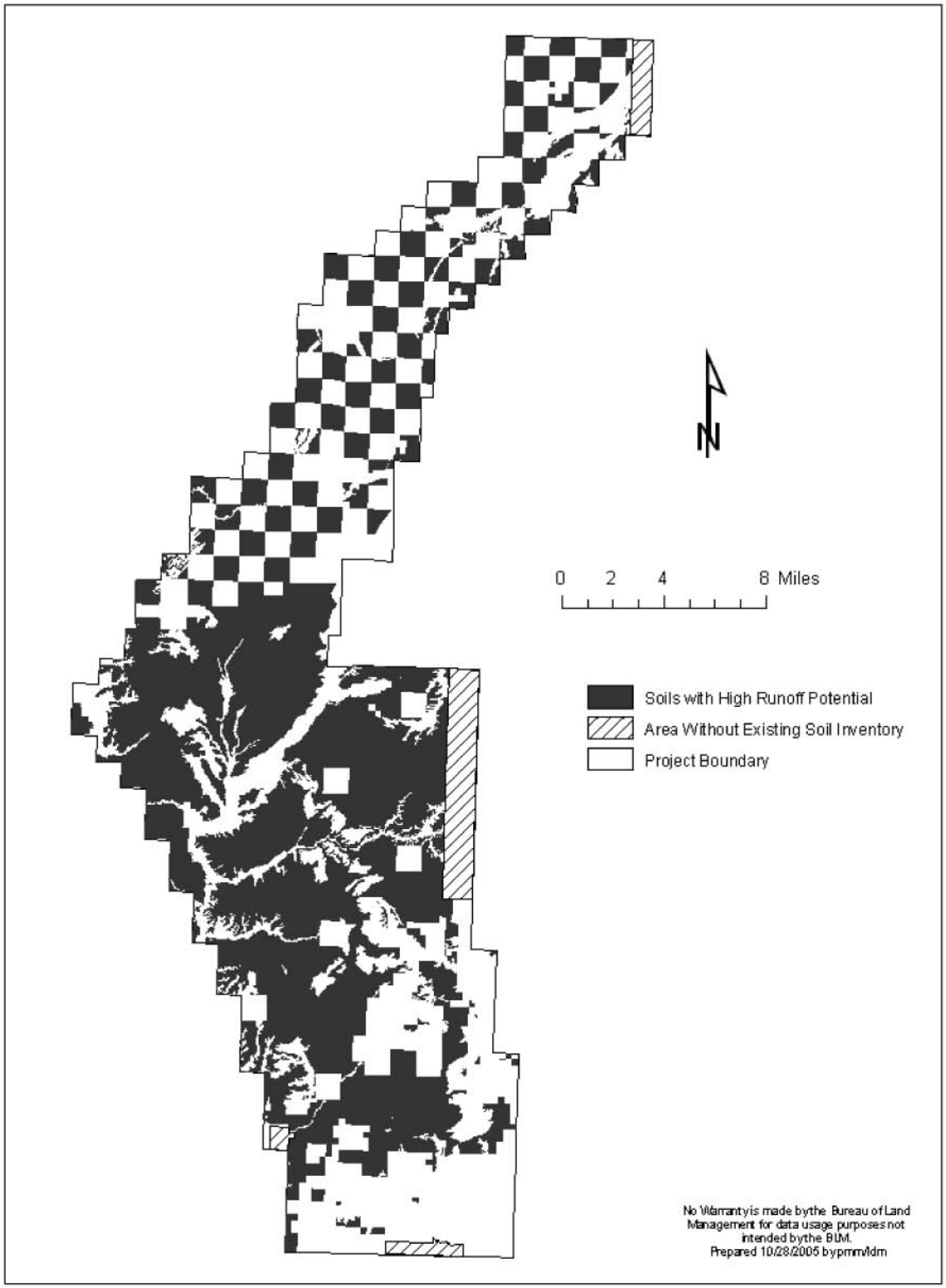
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Slopes Greater than 25%



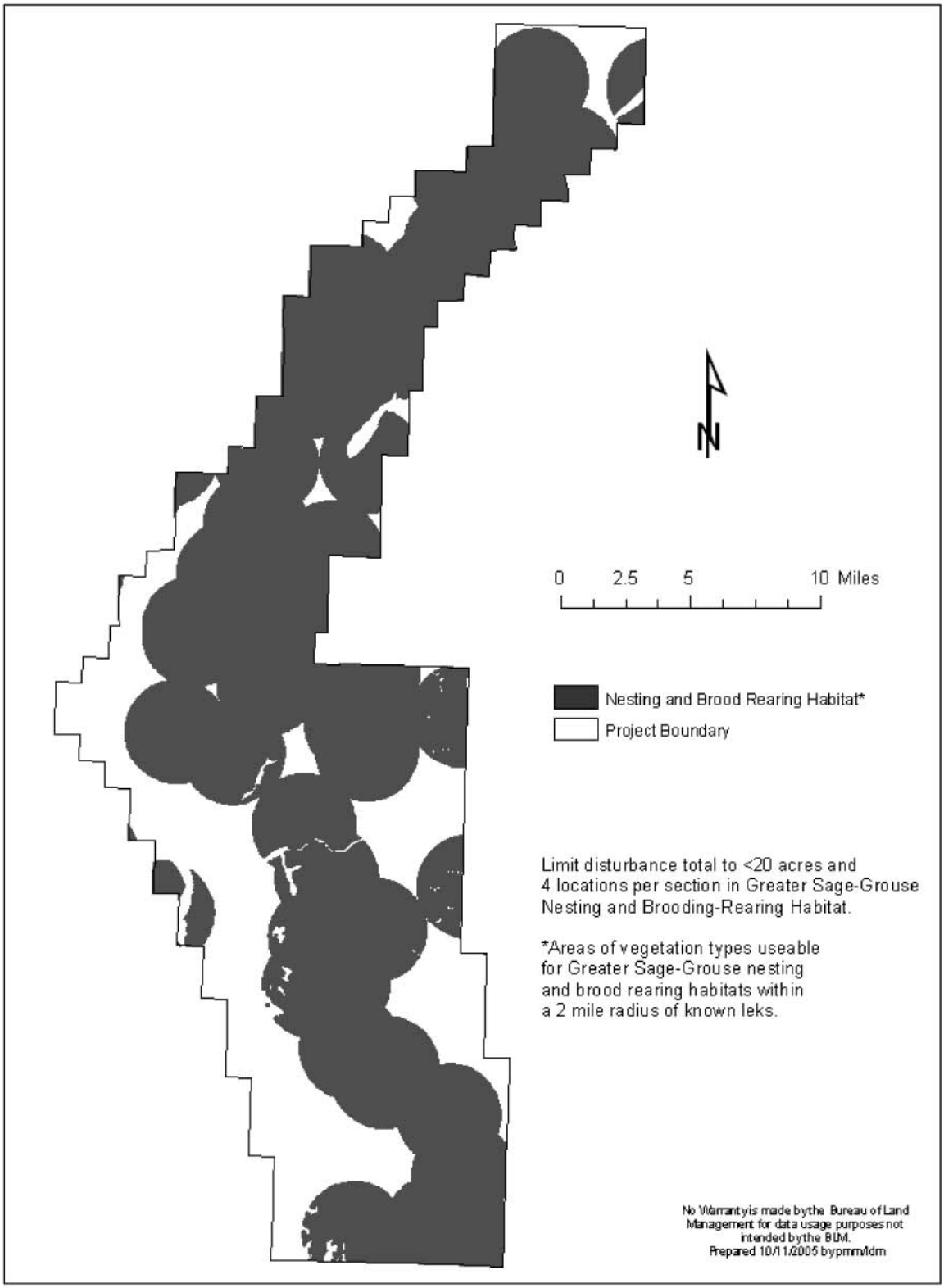
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Perennial Surface Waters and Wetlands



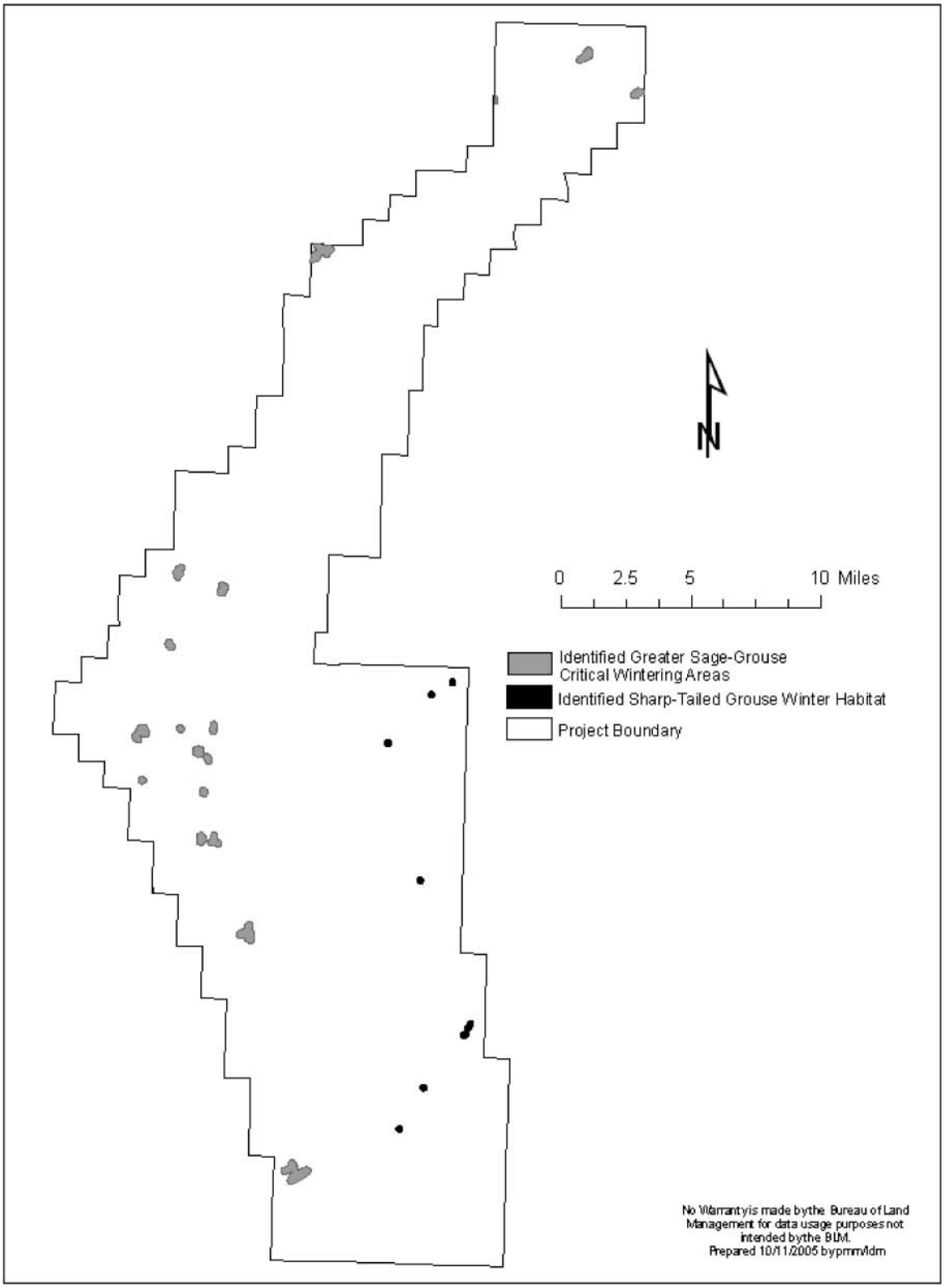
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Soils with High Runoff Potential



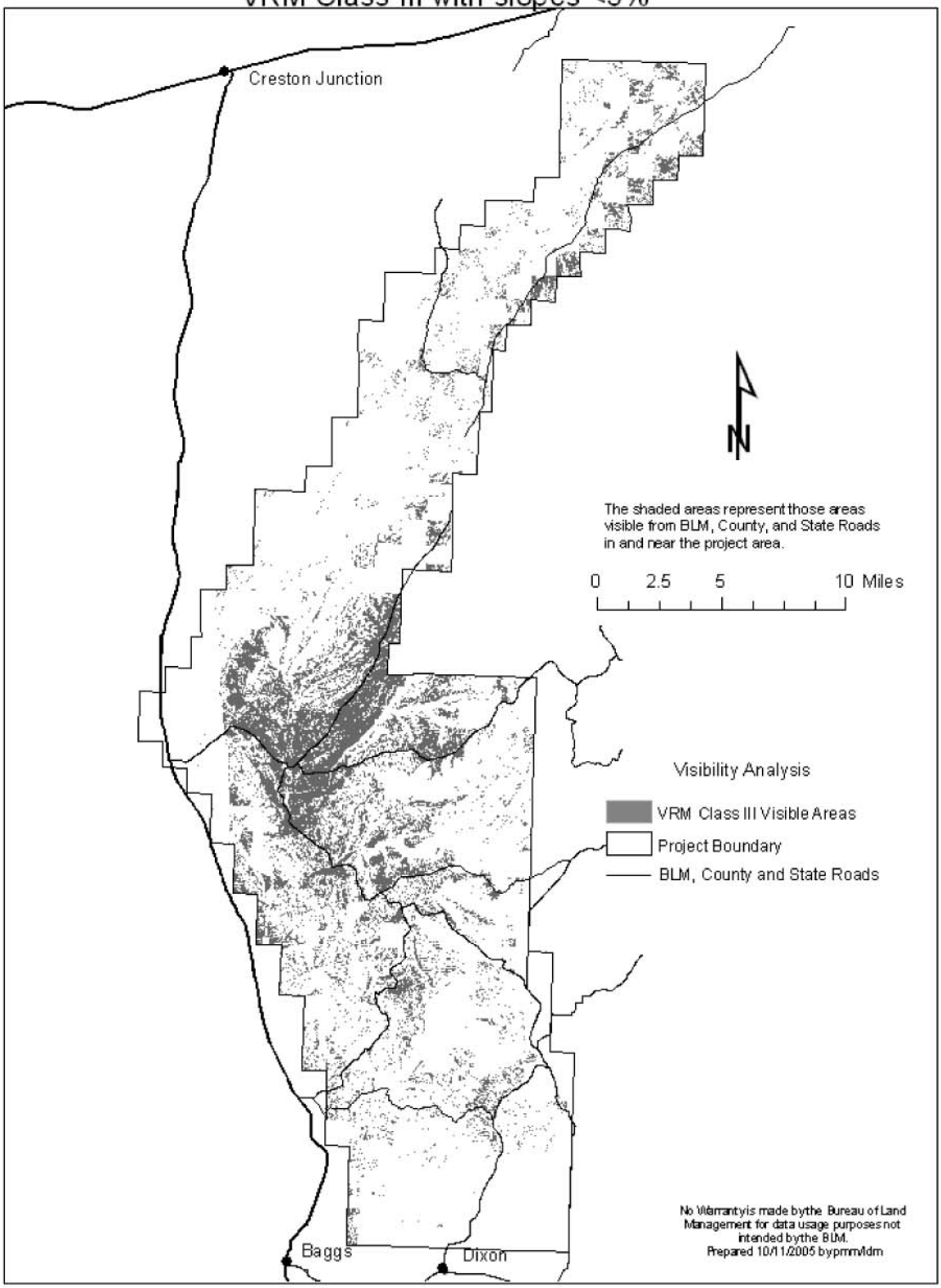
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Greater Sage-Grouse Nesting and Brood-Rearing Habitat



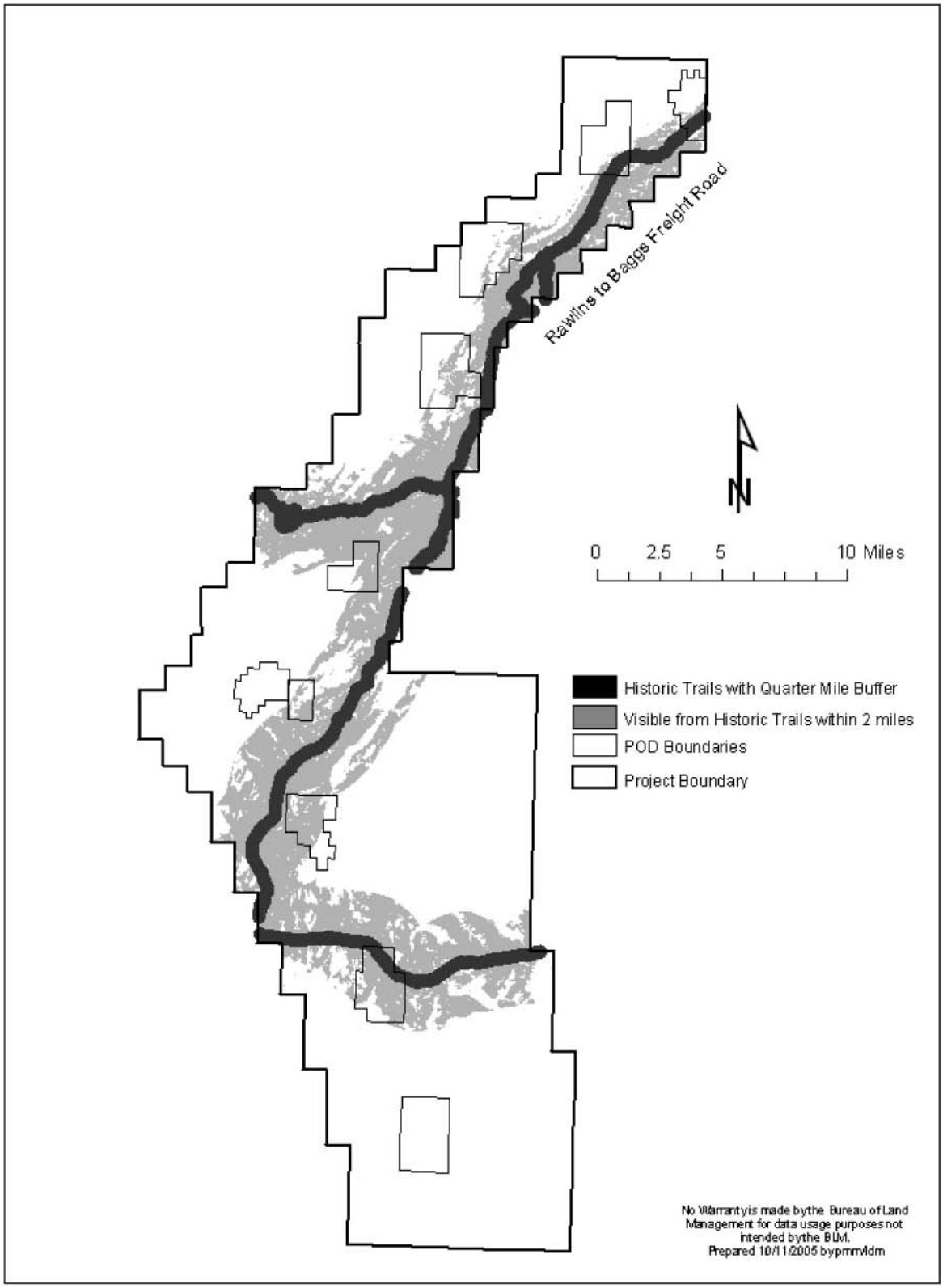
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Grouse Critical Wintering Areas



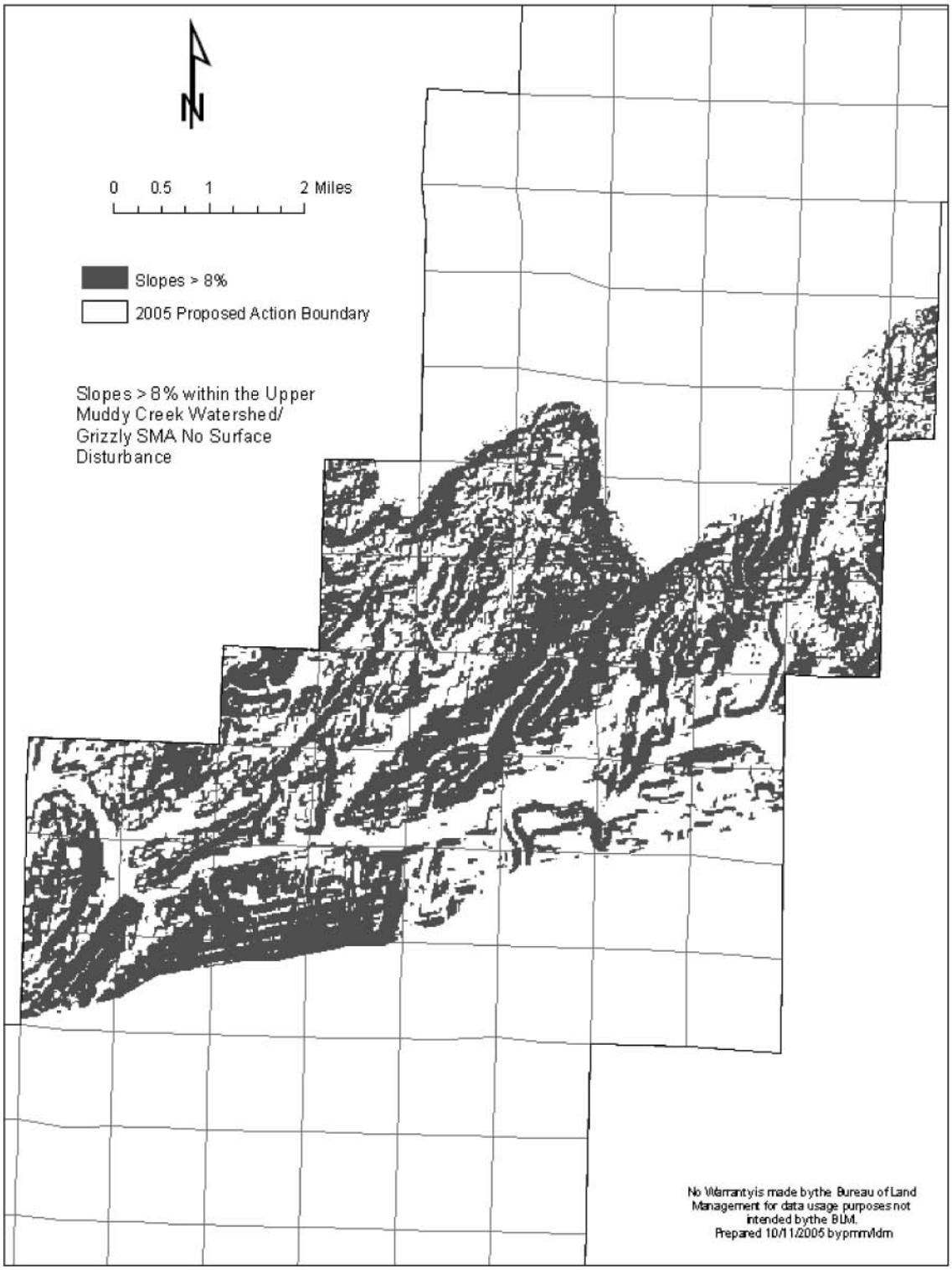
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Areas Visible from Main Roads in
VRM Class III with slopes <5%



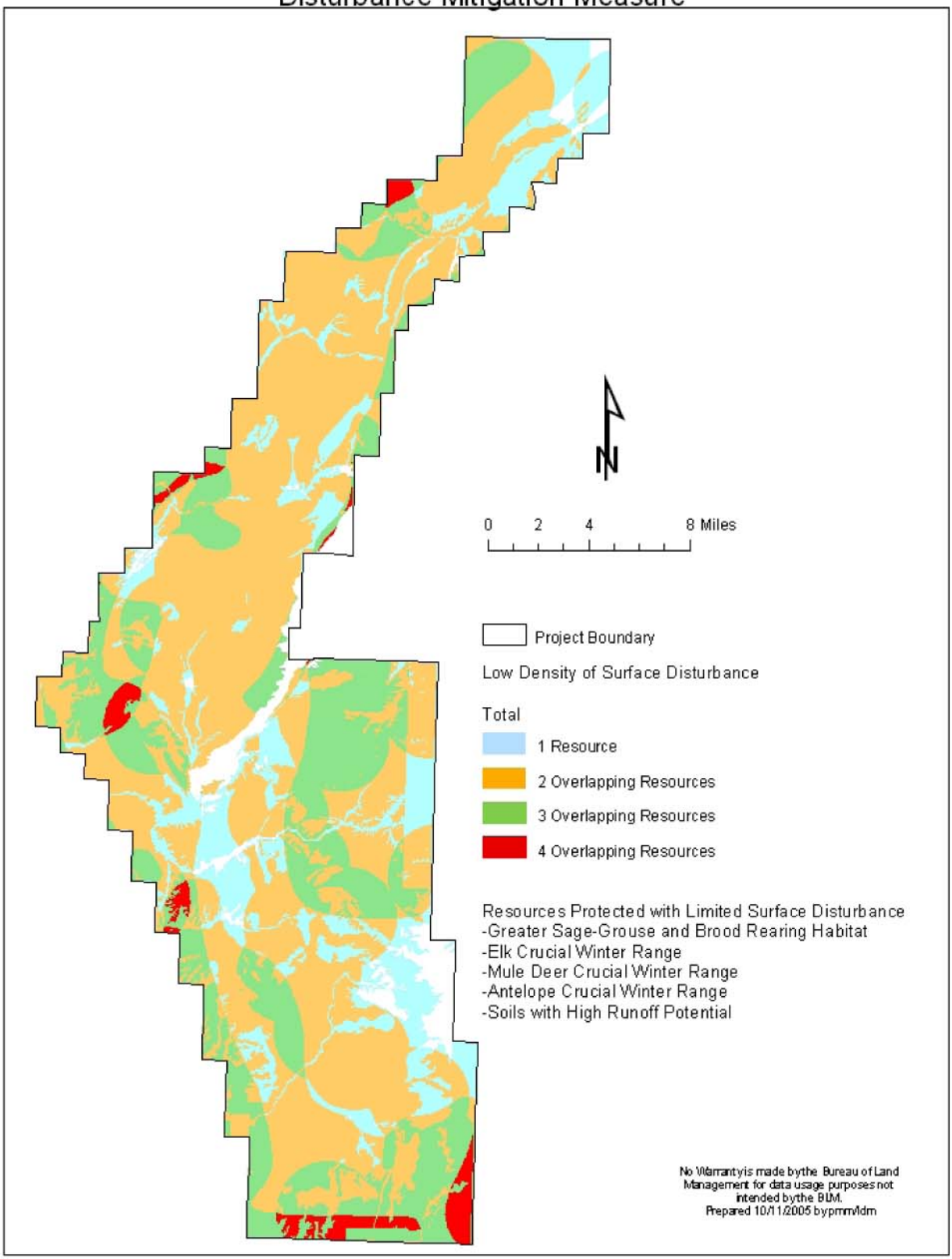
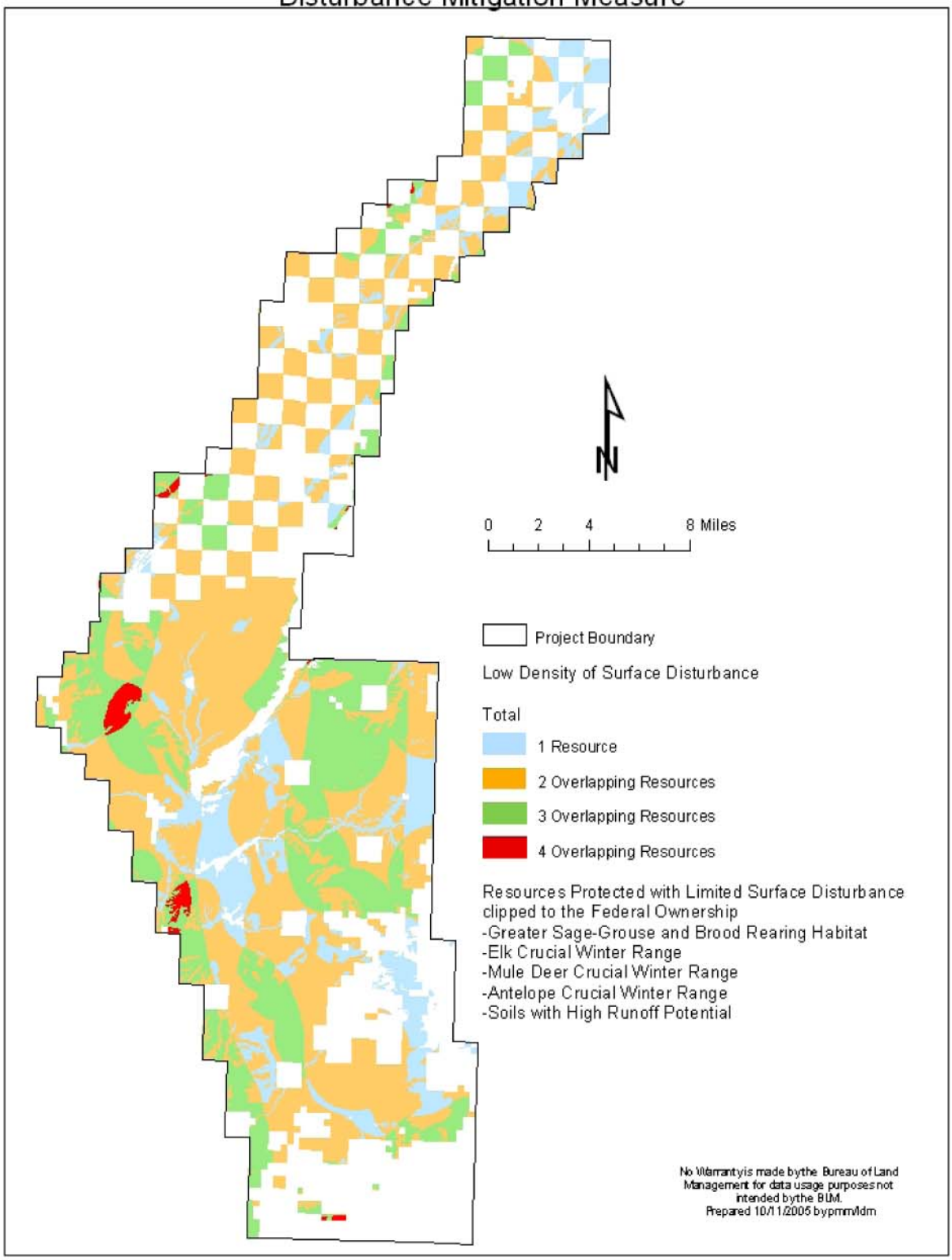
ATLANTIC RIM DRAFT EIS MAP
Alternative C - Historic Trails and 2 mile Visibility



ATLANTIC RIM DRAFT EIS MAP
Alternative C - Muddy Creek SMA
Slopes > 8%



ATLANTIC RIM DRAFT EIS MAP
Alternative C - Resources with Limited Surface Disturbance Mitigation Measure



ATLANTIC RIM DRAFT EIS MAP
Alternative C - Resources with Limited Surface Disturbance Mitigation Measure