BLM

High Desert District - Rock Springs Field Office

Environmental Assessment

Jim Bridger Power Plant 3-D Seismic

and

Electromagnetic Surveys

WYW167761

WY-040-EA10-111

NATIONAL SYSTEM OF PUBLIC LANDS

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Contents

1.0 INTRODUCTION 1

1.1 Purpose and Need for the Proposed Action 1

1.2 Relationship to Statutes, Regulations, Plans, or Other Environmental Analyses 1

1.3 Scoping, Public Involvement and Issues 1

2.0 PROPOSED ACTION AND ALTERNATIVES 3

2.1 Alternative I – No Action Alternative 3

2.2 Alternative II – Proposed Action 3

2.3 Alternatives Considered but Not Analyzed in Detail 5

3.0 AFFECTED ENVIRONMENT 7

3.1 Introduction 7

3.2 Geology 7

3.3 Soils 7

3.4 Vegetation 8

3.5 Noxious Weeds 8

3.6 Water Resources 9

3.7 Wildlife 13

3.8 Special Status Species 15

3.9 Livestock Grazing 18

3.10 Cultural Resources 18

3.11 Recreation 20

3.12 Hazardous or Solid Wastes 20

3.13 Noise 20

4.0 ENVIRONMENTAL EFFECTS 23

4.1 Direct and Indirect Effects 23

4.2 Cumulative Effects 31
4.3 Mitigation Measures 32
4.4 Residual Effects 34
5.0 TRIBES, INDIVIDUALS, ORGANIZATIONS, or AGENCIES CONSULTED 34
6.0 LIST OF PREPARERS 34
6.1 List of Reviewers 35
7.0 REFERENCES 37

1.0 INTRODUCTION

Geokinetics USA, Inc. (Geo) filed a Notice of Intent (NOI) with the Bureau of Land Management (BLM) Rock Springs Field Office (RSFO) on April 29, 2010, to conduct three-dimensional (3-D) and electromagnetic (EM) geophysical exploration in Sweetwater County, Wyoming. The project, hereafter referred to as the Proposed Action, would be near Point of Rocks in Townships 20 and 21 North and Ranges 100 and 101 West (Figure 1-1). The project area covers approximately 39,588 acres of federal, state, and private land. The Proposed Action is needed to effectively evaluate hydrocarbon reserves underlying the project area for potential further development of oil and gas resources.

1.1 Purpose and Need for the Proposed Action

The purpose for the Proposed Action is to provide data to develop a 3-D image of the geologic structure and stratigraphy underlying the project area. The data generated from this survey would significantly enhance the evaluation of the potential mineral resources, thus reducing the potential for non-productive wells and associated construction of new roads, well pads, pipelines, and other ancillary facilities.

According to the Green River Resource Management Plan (RMP) (BLM 1997), the project area is open to consideration of mineral leasing and exploration, except where those activities would cause unacceptable impacts. The objective for seismic surveys is to provide opportunity for collection of geophysical data, while protecting natural resource values. Geophysical activities are required to conform to the off-highway vehicle (OHV) management prescriptions for the planning area. This environmental assessment (EA) will allow the BLM to evaluate the potential impacts of Geo's Proposed Action in light of other resource values and management directives and to decide whether to allow Geo to perform seismic exploration activities within the project area.

Decision to be made: The BLM will decide whether to allow Geo to perform seismic exploration activities within the project area.

1.2 Relationship to Statutes, Regulations, Plans, or Other Environmental Analyses

The Proposed Action is subject to the Green River RMP Record of Decision (ROD) approved on August 8, 1997 (BLM 1997). Management objectives and actions for geophysical exploration are found on page 15 of the Green River RMP ROD, Geophysical Exploration. The objective for management of geophysical exploration activities is to provide an opportunity for exploration of mineral resources and collection of geophysical data, while protecting other resource values. Management actions for geophysical exploration allow for site-specific authorizations for OHV use, subject to appropriate limitations to protect various resources identified during analysis of proposed actions (BLM 1997). This project would not affect the achievement of the Wyoming Standards for Healthy Rangelands.

1.3 Scoping, Public Involvement and Issues

No formal public scoping was conducted for the Proposed Action.

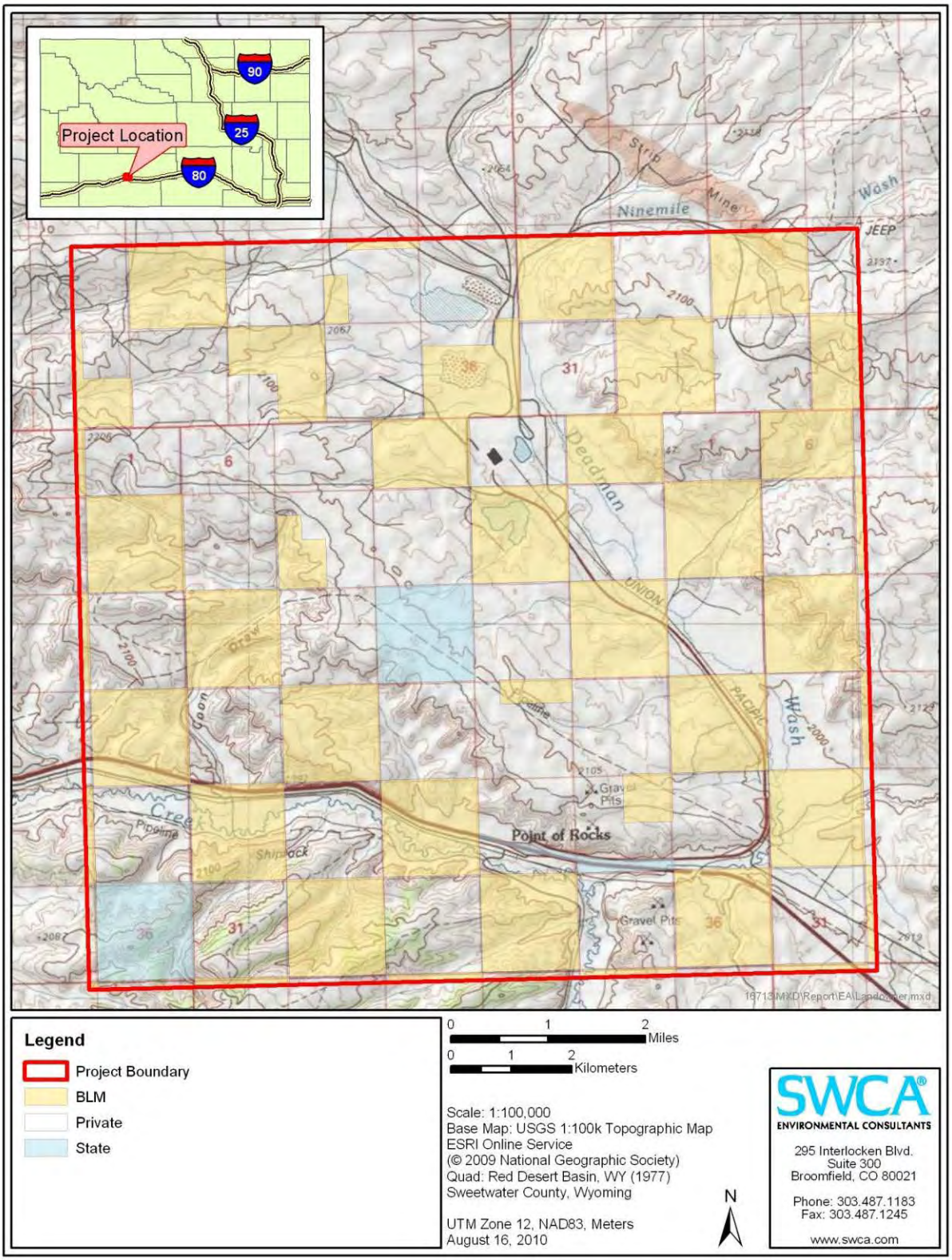

Figure 1-1. **Project location and land ownership**

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Alternative I – No Action Alternative

In accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations, a No Action Alternative is required. The No Action Alternative would be the denial by the BLM of Geo's proposal to conduct the 3-D seismic survey. It serves as a benchmark, enabling decision-makers to compare the magnitude of environmental effects resulting from the Proposed Action with a No Action Alternative. Under the No Action Alternative, there would be no new impacts to vegetation, wildlife, special status plant and animal species, soil, cultural resources, paleontological resources, recreation, surface water and groundwater, range resources, and other resources.

2.2 Alternative II – Proposed Action

The Proposed Action is a 3-D and EM geophysical exploration project on federal, state, and private lands in Sweetwater County, Wyoming, near Point of Rocks, Wyoming, in Townships 20 and 21 North and Ranges 100 and 101 West (Figure 1-1). The project area covers approximately 39,588 acres of federal (40 percent of total acres), state (3 percent), and private (57 percent) land. The Proposed Action is needed to effectively evaluate hydrocarbon reserves underlying the project area for further development of oil and gas resources. The proposed 3-D seismic and EM surveys would avoid all rivers, primary intermittent streams, and wetlands to avoid potential impacts. The duration of the project would be approximately 6 weeks, beginning in October 2010 and be done prior to November 15th.

Acquisition of seismic exploration data involves the synthetic generation of seismic waves and their subsequent detection after passing through or reflecting off the region of interest (i.e., the "target"). A seismic survey typically involves generating hundreds to tens of thousands of seismic source events at established locations in the survey area. The seismic energy generated at each source is detected and recorded at a variety of distances from the source location. To effectively generate 3-D seismic data, receiver points are placed in a grid pattern with multiple source points. Force waves are generated by explosive charges or specially designed "thumper" vehicles and are collected by the receivers and used to generate models of the subsurface geological structures.

Geo would use a Remote Seismic Recorder (RSR) system to facilitate recording operations. The RSR system is a radio telemetry system with which data are recorded in the "box" and then downloaded and processed by a transcriber, creating the actual shot records. Equipment associated with this system would consist of geophones, cables, batteries, and data recording boxes. This equipment would be deployed along receiver lines with the use of a helicopter every six receiver stations. One helicopter would be used for the recording operation and would operate only in daylight hours ferrying the receiver-station cache bags. The helicopter would move six to eight cache bags at a time suspended from a "long-line" operating at an altitude of approximately 100 to 1,000 feet above the receiver lines and deposit one bag at a time at the global positioning system (GPS) pin-flagged locations provided by surveyors.

The Proposed Action would involve approximately 2,520 receiver positions and 2,455 source locations. The receivers would be spaced at line intervals of 1,320 feet oriented in a north to south direction with 220 feet between each individual station. The source lines would be spaced at 1,320 feet oriented in an east to west direction with the individual stations spaced at 220 feet. The sonic energy source would be from the use of vibrator buggies.

Access into the project area would be provided primarily by Interstate-80 (I-80) and Nine Mile Road. In addition, BLM and county roads would be used for rural access and cross-country travel. Crew members would carpool daily to the project area in the morning and return to Rock Springs in the evening. Approximately 50 crew members would conduct operations for 10 to 12 hours per day. Personnel would be organized into working teams (crews) of four to six personnel. These crews would operate independently on each of the receiver lines throughout the project area.

Crew members would walk to the first dropped cache bag on their receiver line, prepare and connect the station, and manually deploy cable and geophones. Seismic cable and geophones connected to the field recording unit (a cubic box 10 × 8 × 8 feet in height) would be laid out by hand around each station in a pre-determined pattern. The geophones would be mounted on a 4-inch spike and placed into the soil using foot pressure. The crew members would then proceed on foot to the second bag and repeat the steps. Cables and geophones would be laid out in this manner at each station across the project area. Approximately 2,160 geophone stations would be active at any time throughout the data acquisition task. Individual troubleshooters (four to six personnel) would repair any line problems that may arise during the recording operations. Trouble-shooting and maintenance operations would be accomplished using all-terrain vehicles (ATVs) traveling on roads, established two tracks, and source and receiver lines that have been cleared of archaeological sites.

Once enough equipment is laid out to complete a recording patch (10 lines × 120 stations on each line), the recording crew would commence with vibroseis operations. During vibroseis operations, four vibroseis buggies would travel to each source point location and emit energy into the subsurface simultaneously through vibration. Each vibroseis buggy would be lifted up onto a vibrator pad mounted to the buggy, and the four buggies would vibrate in unison to create the energy source. The resulting energy wave would be recorded. Geo would use AHV-IV Buggy Vibrators. These vibrators weigh approximately 62,500 pounds and are 30 feet 6 inches long, 11 feet 2 inches wide, and 10 feet 2 inches tall. The vibrators are equipped with large terra tires (66 × 43 × 25 inches) that help to distribute their weight evenly over the substrate to minimize impacts.

An EM survey would follow the 3-D survey. The EM survey would be performed using two methods: Magneto Telluric which is a passive method that uses the earth's electromagnetic field as source, and Controlled Source Electromagnetic with an active source installed. The same receivers are used for both methods. The EM source would be set up in two locations in the same area as the seismic survey. The source consists of one center point with a number of electrodes and eight outer electrode points at a distance of 2 kilometers (km) from the center. The diameter of the source is 4 km. This arrangement is called a circular electric dipole (CED).

The electrodes would be installed using a backhoe with an auger to drill holes of 4-meter depths. The drill diameter would be 2 to 3 inches (5.1 to 7.6 centimeters). Once the drilling is complete, the electrodes would be installed and the holes filled with a mixture of water and bentonite. Water would be obtained from local municipal sources. After installing the electrodes in the center and the eight outer points, cable would be run from the center to the outer points. Up to 20 amperes (amps) are delivered through each cable by a specialized, generator-powered transmitter and fed into the ground at the grounding points. The total current for an eight-cable CED is 160 amps. Data are recorded point by point within the grid on personal digital assistants and downloaded to a main computer during breaks. All electrodes and cables would be removed after the survey. The drilled holes would be filled in and the area properly cleaned.

Recording equipment would initially be transported to the program site staging areas by truck using existing roads and trails. Geo would consult with local land owners to identify potential staging areas at convenient locations on private property throughout the project area. Existing well pads and maintained facilities would be given preference and all equipment and vehicle storage would be located within the perimeter of these staging areas. Smaller temporary staging areas would be located along trails and roads throughout the project area and would be used to expedite the deployment and retrieval of equipment. The helicopter would typically land at these staging areas; however, it may also land adjacent to existing roads and trails to pick up or drop off equipment.

Clean-up would be conducted in conjunction with operations. After recording is completed in each swath (area between two receiver lines), all equipment, trash, and flagging would be completely picked up from the area and placed in cache bags for removal by truck or helicopter. The debris would be collected at the staging areas where personnel would organize materials, handle equipment, and dispose of the used/unusable materials. Material disposal would occur at approved facilities or local land-fills. Lines would be inspected by Geo management personnel or the recording crew prior to departure to insure the project has been reclaimed accordingly. In the event that any materials are buried by snow, these lines would be revisited and materials reclaimed once the snow has melted.

2.3 Alternatives Considered but Not Analyzed in Detail

No unresolved resource conflicts were identified that necessitated development of additional alternatives. Therefore, only the Proposed Action and No Action Alternative were considered.

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

The project area is located near Point of Rocks, Wyoming. I-80 and Bitter Creek extend along the southern boundary and Nine Mile Road and Deadman Wash extend along the eastern boundary. The Jim Bridger Power Plant and its associated facilities and evaporation ponds are located within the northeastern portion of the project area. Existing disturbance and activities associated with the Jim Bridger Power Plant are also located within the project area. This includes surface and underground coal mines, power plant facilities, and evaporation ponds; conveyer belt; railroad tracks; roads; oil and gas wells and associated pad, road, and pipeline facilities; and transmission lines. Other existing land uses in the project area and vicinity include surface and underground coal mining and livestock grazing.

The following critical resources/elements are not present in the project area, or are present but would not be adversely affected by the Proposed Action. These resources are not discussed further in the EA.

- Air Quality
- Areas of Critical Environmental Concern
- Environmental Justice
- Floodplains
- Paleontology
- Prime or Unique Farmlands
- Socioeconomics
- Visual Resources
- Wild and Scenic Rivers
- Wilderness Values

3.2 Geology

The project area is located on the Rock Springs Uplift. Elevations along the Rock Springs Uplift range from 6,500 feet above mean sea level (amsl) near the outer flanks of the uplift to greater than 7,000 feet amsl, with slopes ranging between flat to steeply sloped (0 to 67 percent), although slopes are generally less than 10 percent. Bedrock geology is dominated by Cretaceous-aged sedimentary strata of the Almond River formation overlain by Tertiary-aged exposures and Quaternary-aged alluvial and colluvial deposits and aeolian deposits throughout upland topography (Green and Drouillard 1994). The predominant bedrock consists of a variety of sandstones and shales, which include Ericson and Fox Hill sandstones and Lewis shale. More recent Quaternary-aged deposits have occurred in areas of more topographic extremes and surrounding perennial and intermittent streams.

3.3 Soils

Soils along the Rocks Springs Uplift are largely defined by their geologic parent material (Munn and Arneson 1998) that have developed in a variety of substrate (residuum, alluvium, colluvium, slopewash, and aeolian deposits) on relatively flat terrain in xeric environments dominated by

sagebrush (*Artemisia* spp.) steppe and desert shrub communities. Soils within the project area are predominantly stony, fine-loamy upland soils that contain hard clasts, although fine-loamy to sandy soils of floodplains and bottomlands occur in the vicinity of perennial and intermittent streambeds (Munn and Arneson 1998). Soils in areas of steep slopes (greater than 25 percent) characteristically represent poor, shallow development making them moderately susceptible to erosion (BLM 2008). However, upland and bottomland soils on gentle slopes are stable when vegetation is left intact and disturbance is maintained at low levels. Table 3-1 describes the soils found in the project area and their level of erodibility.

Table 3-1. Soils Found in the Project Area

Description	Acres	Erodibility
Loamy-skeletal, mesic	32,256	Low
Fine-loamy over sandy/sandy-skeletal, mixed, frigid/mesic	2,356	Low
Fine-loamy, mixed, frigid	4,976	Moderate

Sources: Munn and Arneson 1998; BLM 2008

3.4 Vegetation

The project area is dominated by sagebrush steppe and high desert vegetation blending with emergent riparian areas and wetlands associated with intermittent streams and washes. Higher elevations and low annual precipitation are prime determinants of plant species composition, abundance, and distribution along the Rock Springs Uplift. Vegetation communities are generally typified by the Wyoming Basin ecoregion, which is dominated by arid shrublands and grasslands that are interrupted by high hills and low mountains (Chapman et al. 2004).

Vegetation within the Rock Springs Uplift is further defined as sagebrush shrubland and steppe where Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), greasewood (*Sarcobatus* spp.), and saltbush (*Atriplex* spp.) are prominent components. Sagebrush shrubland is interspersed by salt desert shrublands dominated by alkaline-tolerant shrubs and grasses such as greasewood, Gardner's saltbush (*Atriplex gardneri*), shadscale (*Atriplex confertifolia*), bud sage (*Picrothamnus desertorum*), and basin big sagebrush (*A. t.* ssp. *tridentata*). Big sagebrush shrubland and steppe comprises approximately 75 percent of the project area (U.S. Geological Survey [USGS] 2006). Gravelly slopes and hillsides are predominantly covered with sparsely vegetated cushion plant communities dominated by phloxes (*Phlox* spp.), goldenweed (*Stenotus* spp.), and low sagebrush.

3.5 Noxious Weeds

The Wyoming State Legislature enacted the Wyoming Weed and Pest Control Act in 1973 for the purpose of controlling designated weeds and pests. Executive Order (EO) 13112, "Invasive Species," was signed by President Clinton in 1999 to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. According to the Wyoming Cooperative Agricultural Pest Survey, there are 24 state-designated noxious weeds, and five county-designated weeds in Sweetwater County (Wyoming Weed and Pest Council 2010). Industrial (primarily gas and coal development) and agricultural land uses have increased the incidence of invasive and undesirable plant species within the Greater Green River Basin and surrounding areas (BLM 2008).

Table 3-2 presents a list of noxious weeds and other invasive plant species observed in the project area by an SWCA Environmental Consultants (SWCA) biologist during field reconnaissance on July 28, 2010. Weeds are most common in the areas that have been disturbed and not successfully reclaimed and revegetated. The primary vectors for noxious weeds are wind, birds, and other wildlife. Additional sources of invasion include gravel obtained from outside the project area and soil carried to the area on vehicles.

Table 3-2. Noxious Weeds and Invasive Species Known to Occur in the Project Area, 2010

Common Name	Scientific Name	Wyoming Noxious Weed List	Sweetwater County Noxious Weed List
Canada thistle	*Cirsium arvense*	Yes	No
Cheatgrass	*Bromus tectorum*	No	No
Tansymustard	*Descurainia sophioides*	No	No
Perennial pepperweed	*Lepidium latifolium*	Yes	No

Source: Wyoming Weed and Pest Council 2010.

3.6 Water Resources

Water resources in the project area include surface water and groundwater, as well as the associated wetland and riparian habitats.

3.6.1 Surface Water, Wetlands, and Riparian Habitat

The analysis area for surface water for this EA includes the named and unnamed drainages that cross the project area as depicted in the USGS 1:100K topographic map of the Red Desert Basin, Wyoming Quadrangle. Surface waters in the project area are associated with the named drainages of Deadman Wash, Threemile Meadow, Upper Bitter Creek, and Coon Draw; unnamed drainages; and lacustrine or open water features associated with the Jim Bridger Power Plant. These named and unnamed tributaries all flow to the middle Bitter Creek drainage which connects with the Green River approximately 35 miles west of the project area. The general project area is located along the Rock Springs Uplift and riparian and wetland areas in the area are associated with the perennial stream of Deadman Wash and other intermittent named and unnamed streams. Riparian habitats and wetlands may also occur around springs, seeps, depressions, and open water features associated with the Jim Bridger Power Plant. Surface water influx to these surface water systems may come from base flows, localized precipitation, and spring snowmelt; however, some influx to drainages may result from discharges from the open water lakes and ponds that are associated with dewatering and cooling operations at the power plant. The project area receives an average of 8 to 10 inches of precipitation annually (USGS 2005; Martner 1986).

According to the Wyoming Surface Water Classification List, Deadman Wash upstream of the power plant is of a 3B water classification (Wyoming Department of Environmental Quality [WDEQ] 2010). Class 3 waters provide habitat for aquatic life other than fish, and benefits for recreation, wildlife, industry, agriculture, and scenic value (WDEQ 2010). Below the power plant, Deadman Wash is considered a 2AB warm water body that has, upstream of Class 3 waters, the potential to provide habitat to both game and non-game fisheries as well as provide a source of domestic drinking water. Bitter Creek in the project area is classified as a 3B water with no potential for fisheries or drinking water (WDEQ 2010). Other intermittent and ephemeral streams in the project area are not classified by the WDEQ.

Wetland and riparian areas perform a myriad of functions, including flood attenuation, aquifer recharge, surface water filtration, wildlife habitat, grazing forage, and embankment stabilization. In comparison to other vegetative communities in the project area, wetlands and riparian areas exhibit a relatively high amount of plant diversity which results in higher wildlife utilization compared to terrestrial habitats or upland areas in the project area. Wetlands, floodplains, and riparian areas within the project area are predominantly associated with the upper tributaries of the Green River. Aquatic resources have been classified by Cowardin, et al. (1979) and mapped through the efforts of the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) as seen in Figure 3-1.

Wetlands and riparian habitats in the project area are found where surface water influx creates at least periodic saturation or inundation that leads to the development of hydric soils and hydrophitic vegetative communities. Vegetation in wetlands and riparian areas within the project area is directly correlated to the amount of available surface waters during the warmer growing season. Typical vegetation in wetland and riparian areas include cattails (*Typha* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp), bluegrass (*Poa* spp.), greasewood, forbs, and other herbaceous species. Wetland and riparian tree and shrub species are observed to be of minimal composition in the project area.

3.6.2 Groundwater

The subject area is located in the Upper Green River watershed encompassing some or parts of Hydrological Units 140401050302, 140401050303, 140401050304, 14040105301, and 140401050304 (see Figure 3-2). The Middle Deadman Wash and Bitter Creek-Coon Draw watersheds comprise the majority of the project area. The Town of Superior aquifer recharge area is located in the northwest portion of the project area within the Middle Deadman Wash hydrological unit (BLM 1997) (Figure 3-1). A comprehensive assessment of groundwater resources in Sweetwater County was completed by the USGS in 2005 and provides detailed information pertaining to water resources in the subject area. Both water table and artesian conditions are present in the project area. Shallow groundwater is available throughout the project area although most shallow waters are marginally suitable or unsuitable for domestic and irrigation use due to the high levels of total dissolved solids (TDS) (USGS 2005). Most shallow groundwater in the subject area is suitable for livestock (USGS 2005).

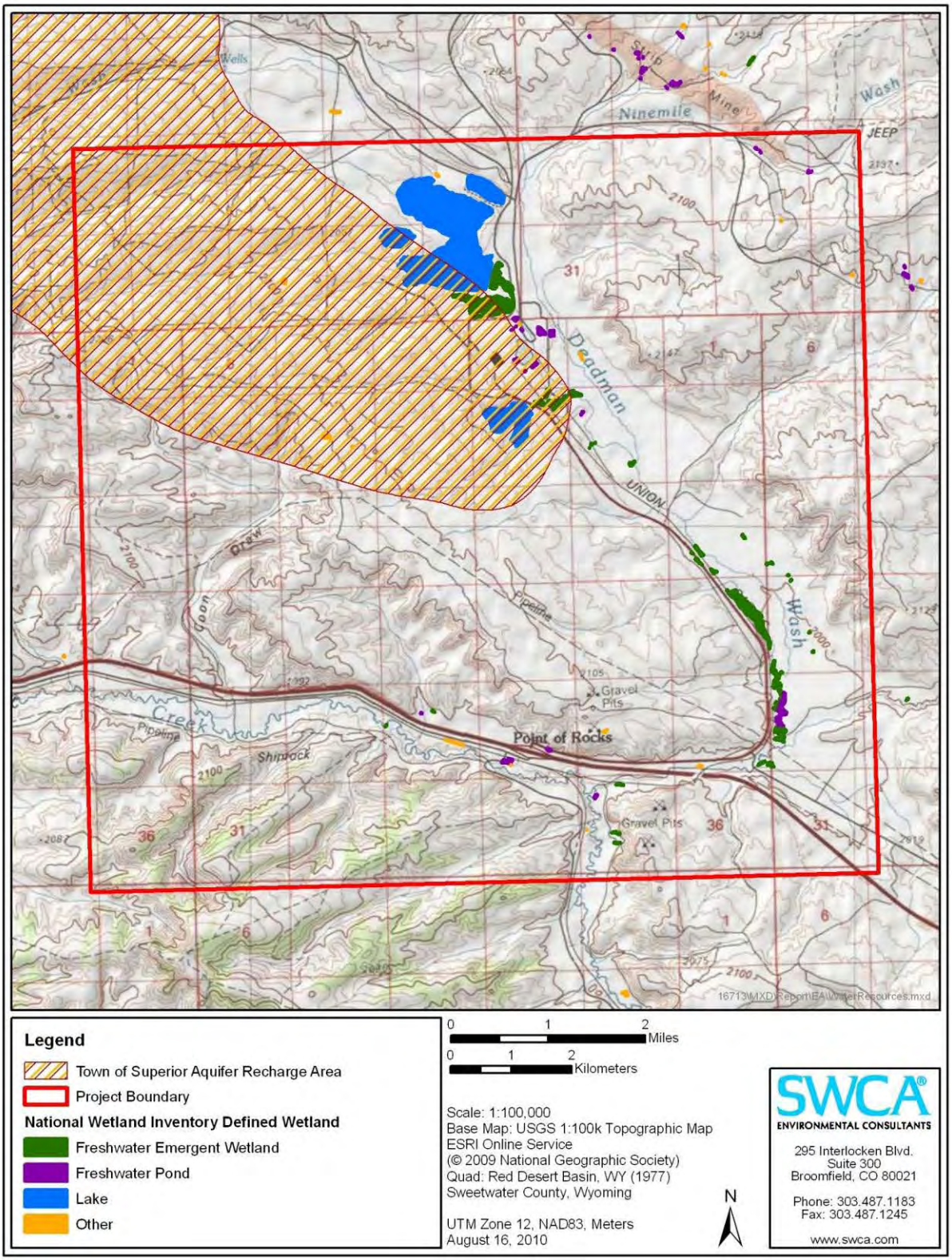

Figure 3-1. Aquifer Recharge Area and NWI Wetlands in the Project Area

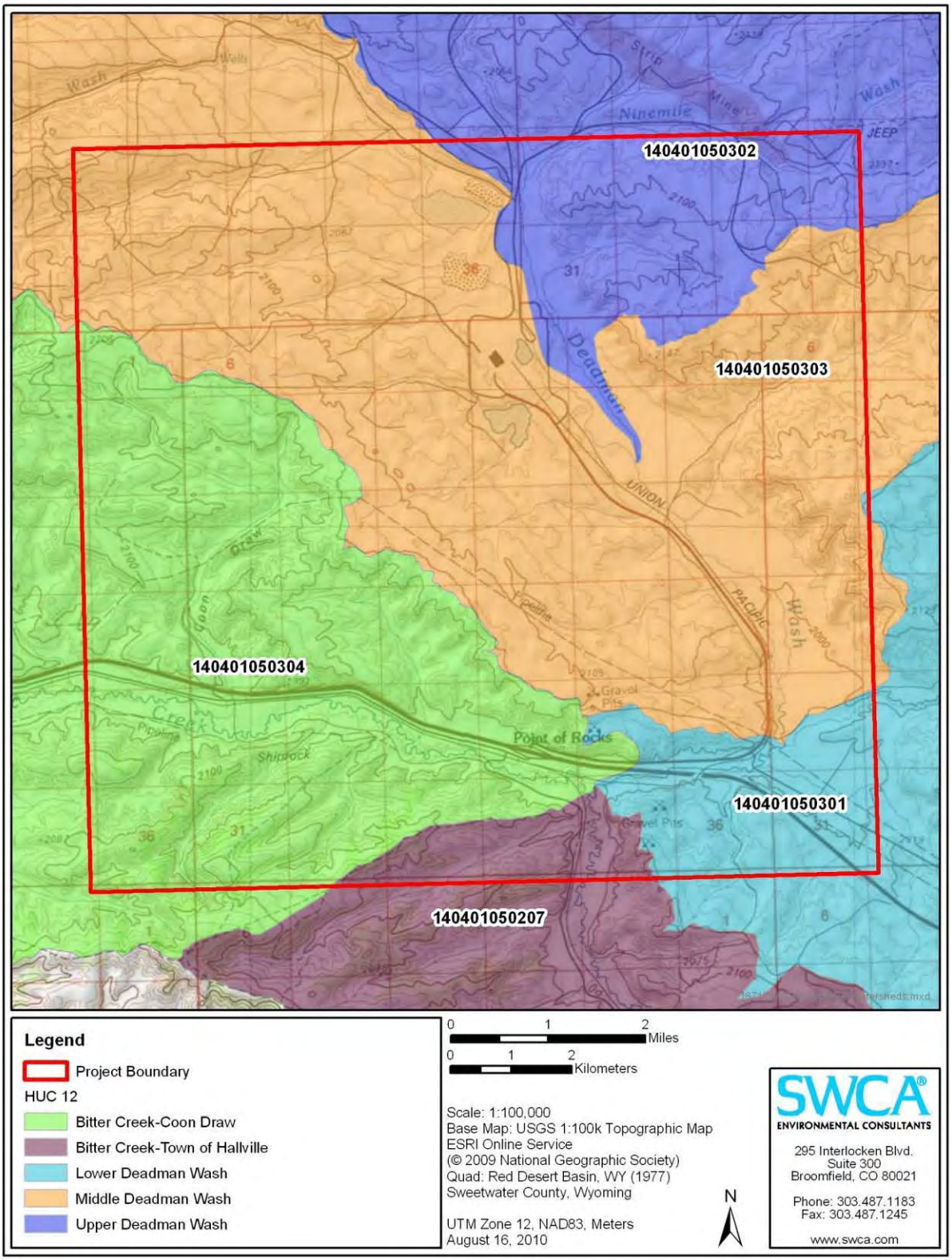

Figure 3-2. Hydrological Units within the Project Area

According to the Wyoming State Engineer's Office (WSEO), 205 recorded water wells are located within the project area and within 0.5 mile adjacent to the project area (WSEO 2010). Of the 205 drilled water wells, three are for domestic use and two are for industrial use. The balance of the wells are for miscellaneous and monitoring use and are associated with the Union Pacific Railroad, PacifiCorp's Jim Bridger Power Plant, Black Butte Coal Company, Pacific Power and Light, Bridger Coal Company, and PacifiCorp Environmental Remediation Company (WSEO 2010). Based on the WSEO, wells in the subject area are used for a variety of purposes including industrial use, dewatering, reservoir storage, and groundwater monitoring. Over 175 wells in the subject area are for monitoring usage.

The primary water-bearing aquifers, and most widely used in Sweetwater County, are in the Tertiary (65 to 1.8 million years ago) Green River and Wasatch formations (USGS 2005). In the subject area around the Rock Springs Uplift, aquifers below the Lower Tertiary in Quaternary hydrogeologic units are drilled for water usage (USGS 2005). Aquifers in the Quaternary hydrological units consisting of alluvium, lacustrine or gravel deposits, and loess are generally unconfined aquifers. Most of the drilled wells in the subject area are for groundwater monitoring and are above depths of 200 feet from the surface. The depths of drilled domestic wells in the subject area range from 90 to 340 feet below the surface (WSEO 2010). The deepest well in the subject area is approximately 1,450 feet in depth and is permitted for industrial usage (WSEO 2010).

Groundwater quality deteriorates as the distance increases from recharge areas and with increasing depth below the surface (USGS 2005). In the subject area, groundwater at depths below 2,000 feet tends to have high concentrations of TDS which makes groundwater moderately briny (USGS 2005). Specific constituents in shallow and deeper groundwater in the subject area may occur in relatively high concentrations when compared to U.S. Environmental Protection Agency (EPA) drinking water standards. These constituents include sulfates, fluoride, boron, iron, and manganese (USGS 2005).

3.7 Wildlife

Predominant wildlife in the project area includes species associated with the sagebrush-steppe habitat of the area. Common wildlife observed in the project area during biological surveys included coyote (*Canis latrans*), badger (*Taxidea taxus*), desert cottontail (*Sylvilagus audubonii*), and Wyoming ground squirrel (*Urocitellus elegans*). See Section 3.8 for discussion of special status wildlife species.

Big game in the area are managed by the Wyoming Game and Fish Department (WGFD) and include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*). WGFD has mapped big game crucial range in areas that are important for a population's ability to maintain itself at a specified level over the long term. Approximately 21,190 acres of the project area are within crucial range for pronghorn and 6,416 acres are within crucial range for mule deer (Figure 3-3). There are no big game migration corridors mapped within the project area.

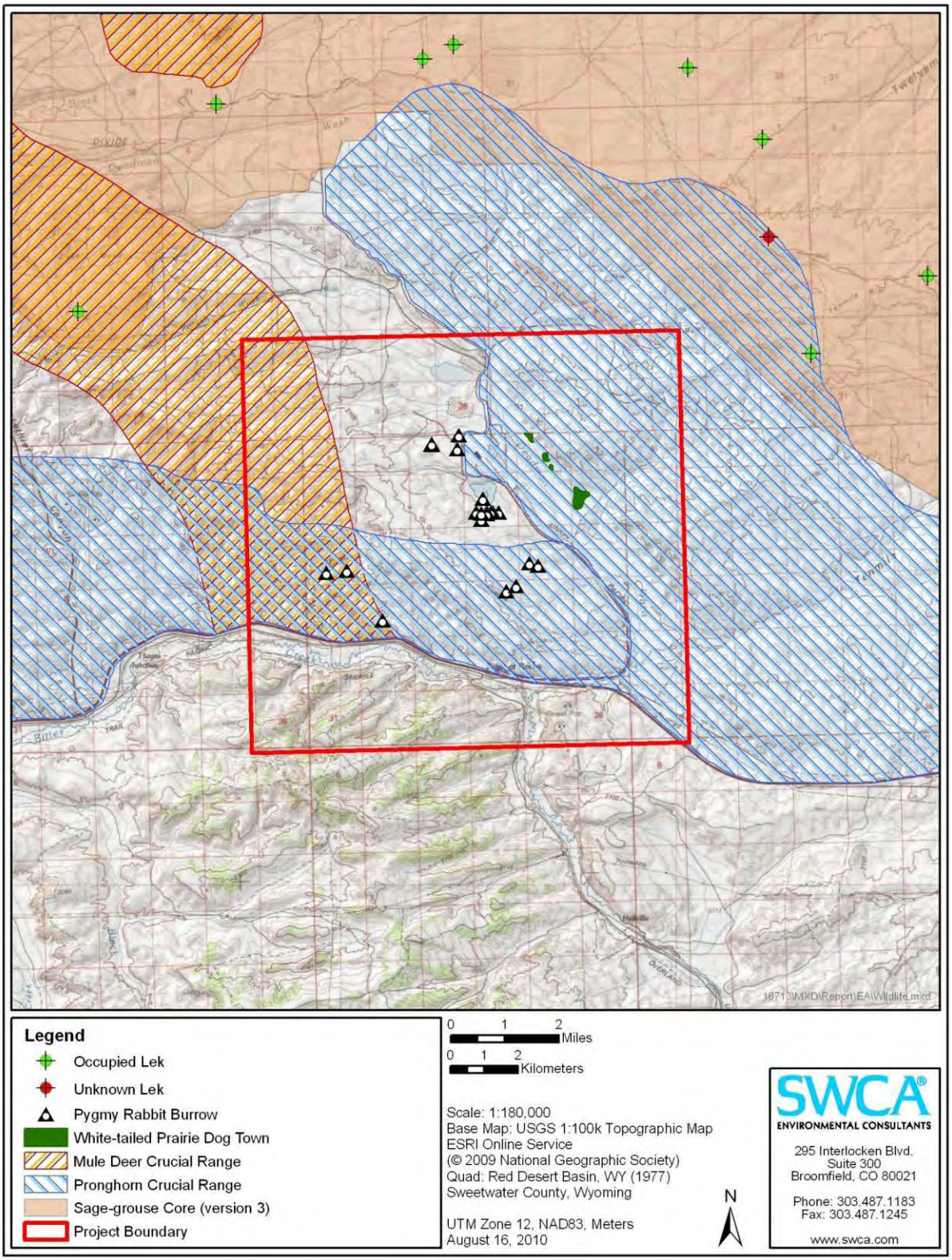

Figure 3-3. Sensitive Wildlife in the Project Area

Wildlife surveys have been conducted for the Leucite Hills Mine project area and the Bridger Coal Company annually monitors 158 square miles around the project area for raptors and other wildlife. Raptors reported in these wildlife studies that may use the project area for nesting and foraging include red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk (*B. regalis*), northern harrier (*Circus cyaneus*), great horned owl (*Bubo virginianus*), long-eared owl (*Asio otus*), burrowing owl (*Athene cunicularia*), prairie falcon (*Falco mexicanus*), American kestrel (*F. sparverius*), bald eagle (*Haliaeetus leucocephalus*), and golden eagle (*Aquila chrysaetos*) (Bridger Coal Company 2009; Tetra Tech 2008). Although there are few trees available in the project area for nesting, cliffs provide raptor nesting habitat. According to BLM data, red-tailed hawk, ferruginous hawk, northern harrier, great horned owl, prairie falcon, American kestrel, and golden eagle nest within the project area.

Other migratory birds commonly observed in the vicinity include sagebrush obligate species such as Brewer's sparrow (*Spizella breweri*), sage sparrow (*Amphispiza belli*), and sage thrasher (*Oreoscoptes montanus*) (Bridger Coal Company 2009). Waterfowl and shorebirds may be attracted to the area due to the cooling ponds associated with the Jim Bridger Power Plant; however, the power plant uses hazing techniques to keep birds from using these ponds (BLM 2002).

As discussed in the Water Resources section, Deadman Wash above the power plant is classified as a 3B water and is capable of providing habitat for aquatic life other than fish and benefits for wildlife (WDEQ 2010). Downstream of the power plant, Deadman Wash is classified as a 2AB warm water body with the potential to provide habitat to both game and non-game fisheries.

3.8 Special Status Species

Special status species evaluated within the project area include animals and plants listed or proposed by the USFWS under the ESA and those on the BLM list of sensitive species (BLM 2010a).

3.8.1 Threatened and Endangered Species

The USFWS lists four animal species and two plant species in Sweetwater County as threatened, endangered, candidate, or proposed species under the Endangered Species Act (ESA) (Table 3-3). Based on lack of suitable habitat, yellow-billed cuckoo and blowout penstemon would not occur in the project area and are not further analyzed.

Table 3-3. ESA Listed Species Known to Occur in Sweetwater County, Wyoming

Species	Status	Habitat
Black-footed ferret (*Mustela nigripes*)	Endangered	Large prairie dog complexes.
Yellow-billed Cuckoo (*Coccyzus americanus*)	Candidate	Large, unfragmented riparian stands dominated by cottonwood (*Populus* spp.) and willow (*Salix* spp.) with a well-developed understory below 7,000 feet elevation.
Greater sage-grouse (*Centrocercus urophasianus*)	Candidate	Sagebrush-steppe habitats.
Mountain plover (*Charadrius montanus*)	Proposed Threatened	Xeric uplands with pebbly soils and low-growing or no vegetation; and lowland flats with little to no vegetation, including prairie dog towns.
Blowout penstemon (*Penstemon haydenii*)	Endangered	Sparsely vegetated, crater-like blowout depressions, on steep slopes at 5,860–7,440 feet in elevation.
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Moist stream banks, wet meadows, and abandoned stream channels; <7,000 feet in elevation.

Source: USFWS 2010.

Potential habitat for black-footed ferret and mountain plover includes the white-tailed prairie dog (*Cynomys leucurus*) towns within the project area (Figure 3-3). Prairie dog towns that are large and close to one another provide conditions that may be suitable for black-footed ferrets. However, ferrets are highly unlikely to be present in the project area or vicinity since minimal prairie dog habitat is available and ferrets have not been observed during the 30 years of wildlife surveys in the area (Bridger Coal Company 2009). Mountain plover could occur in prairie dog towns or other flat, open areas of the project area, although there are no records for this species in the project area or within 4 miles (Wyoming Natural Diversity Database [WYNDD] 2010).

The analysis area for greater sage-grouse includes the project area and a 4-mile buffer (BLM 2010b). Currently, there are no leks located within the project area; one occupied lek and one unknown status lek are located within 4 miles of the project boundary to the northeast (WGFD 2009) (Figure 3-3). Since the majority of nesting greater sage-grouse are found within 4 miles of an occupied lek (Holloran and Anderson 2005; Holloran et al. 2007), a 4-mile buffer around occupied and unknown leks was used to evaluate nesting and early brood-rearing habitat in the project area (totaling 3,543 acres within the project area and 55,385 acres within 4 miles). The project area is not within a sage-grouse core area; however a core area is located approximately 0.5 mile to the northeast of the project boundary and 23,154 acres of this core area are within the 4-mile buffer. In addition, sage-grouse winter locations have been documented within the core area and wintering sage-grouse would be expected to use the northeastern and northwestern corners of the buffered project area (BLM 2010c).

Records of Ute ladies'-tresses are known mostly from the southeast corner of Wyoming in Goshen, Laramie, Converse, and Niobrara counties, and from the central portion of the state (Fertig et al. 2005). It is unlikely for this species to occur in the project area, although a small area of potential habitat occurs along Bitter Creek near the southern boundary based on a habitat model (SWCA 2010a). No Ute ladies'-tresses were observed during July 2010 rare plant surveys performed by SWCA botanists, although some marginal habitat was noted along Bitter Creek.

BLM Sensitive Species

The sensitive species list for the BLM RSFO (BLM 2010a) was reviewed for sensitive animal and plant species with potential to occur in the project area. Those species that may occur based on known records, or presence of suitable habitat, are presented in Table 3-4.

Table 3-4. BLM Sensitive Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Habitat
MAMMALS		
Pygmy rabbit	*Brachylagus idahoensis*	Tall, dense sagebrush, basin-prairie and riparian shrub
Townsend's big-eared bat	*Corynorhinus townsendii*	Forests, basin-prairie shrub, caves and mines
White-tailed prairie dog	*Cynomys leucurus*	Basin-prairie shrub, grasslands
Spotted bat	*Euderma maculatum*	Cliffs over perennial water, basin-prairie shrub
Long-eared myotis	*Myotis evotis*	Conifer and deciduous forests, caves and mines
Wyoming pocket gopher	*Thomomys clusius*	Meadows with loose soil, saltbush, bare ground
BIRDS		
Sage sparrow	*Amphispiza belli*	Basin-prairie shrub, mountain-foothill shrub
Burrowing owl	*Athene cunicularia*	Grasslands, basin-prairie shrub, prairie dog towns
Ferruginous hawk	*Buteo regalis*	Basin-prairie shrub, grassland, rock outcrops
Trumpeter swan	*Cygnus buccinator*	Lakes, ponds, rivers
Peregrine falcon	*Falco peregrinus*	Tall cliffs
Bald eagle	*Haliaeetus leucocephalus*	Primarily along rivers, streams, lakes, and waterways
Loggerhead shrike	*Lanius ludovicianus*	Basin-prairie shrub, mountain-foothill shrub
Sage thrasher	*Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothill shrub
Brewer's sparrow	*Spizella breweri*	Basin-prairie shrub
AMPHIBIANS		
Northern leopard frog	*Rana pipiens*	Beaver ponds, permanent water in plains and foothills
Great Basin spadefoot	*Spea intermontana*	Spring seeps, permanent and temporary waters
PLANTS		
Meadow pussytoes	*Antennaria arcuata*	Moist, hummocky meadows, seeps or springs surrounded by sage/grasslands at 4,950–7,900 feet elevation
Trelease's milkvetch	*Astragalus racemosus* var. *treleasei*	Sparsely vegetated sagebrush communities on shale or limestone outcrops and barren clay slopes at 6,500–8,200 feet elevation
Cedar Rim thistle	*Cirsium aridum*	Barren, chalky hills, gravelly slopes, and fine-textured, sandy-shaley draws at 6,700–7,200 feet elevation
Beaver Rim Phlox	*Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, or limestone substrates at 6,000–7,400 feet elevation
Tufted Twinpod	*Physaria condensata*	Sparsely vegetated shale slopes and ridges at 6,500–7,000 feet elevation
Green River Greenthread	*Thelesperma caespitosum*	White shale slopes and ridges of Green River Formation at 6,300 feet elevation

Sources: BLM 2010a and WYNDD 2010.

Pygmy rabbit and white-tailed prairie dogs are known to occur in the project area, and long-eared myotis has been documented within 4 miles of the project (WYNDD 2010). Townsend's big-eared bat, spotted bat, and Wyoming pocket gopher potentially occur in the project area based on suitable habitat and known range for these species. The project area was surveyed by SWCA biologists for prairie dogs, pygmy rabbits, and Wyoming pocket gopher in July 2010. Prairie dog towns and pygmy rabbit locations are illustrated on Figure 3-3. No Wyoming pocket gophers or mounds were observed within the survey area.

Sensitive bird species with potential to nest, forage, or migrate through the project area are listed in Table 3-4. Based on BLM data, ferruginous hawks are known to occur in the project area. Ferruginous hawk and sage sparrow were observed during July 2010 biological surveys. There are no known occurrences of northern leopard frog and Great Basin spadefoot toad in the project area, but it is possible these species could occur along creeks and ponds within the project area.

A list of sensitive plant species that potentially occur in the vicinity of the proposed project area was compiled through discussions with the BLM High Desert District (HDD) botanist. The BLM HDD botanist confirmed a final list of three species to be targeted for survey based on occurrence records and knowledge of the vegetation and habitat characteristics within the project area (BLM 2010d). A habitat model for the project area identified potential habitat for Cedar Rim thistle (*Cirsium aridum*), Beaver Rim phlox (*Phlox pungens*), and mystery wormwood (*Artemisia biennis* var. *diffusa*), and these species were the target of rare plant surveys in July 2010 (SWCA 2010a). Mystery wormwood was recently removed from the BLM sensitive species list; however, suitable habitat of mystery wormwood was surveyed following discussions with the BLM HDD botanist (BLM 2010d). No rare plants were observed during the surveys. Marginal habitat for Cedar Rim thistle was noted southeast of the power plant. Suitable habitat for the other rare plants was not found at the projected locations. Based on elevation, topography, hydrology, and substrate in the project area, additional BLM sensitive species such as meadow pussytoes, Trelease's milkvetch, tufted twinpod, and Green River greenthread have potential to occur within the vicinity of the project area (WYNDD 2010); however, these species were not identified as target species by the BLM HDD botanist (BLM 2010d) and were not surveyed for.

3.9 Livestock Grazing

The entire project area is located within the Rock Springs grazing allotment. The Rock Springs allotment contains 956,682 acres of public land, 98,795 acres of other federal land, 20,782 of state land, and 984,803 acres of private land for a total of 2,061,062 acres. Of the 148,465 animal unit months (AUMs) available within the Rock Springs grazing allotment, usage is approximately 107,900 AUMs (73 percent of the available AUMs). Grazing privileges (including federal and state grazing allotments) within the proposed project area are permitted for cattle and sheep. Most of the use occurs in the northeast corner of the project area due to topography. Use is primarily in the winter from December 1 through May 15 (BLM 2010e). Stocking rates for livestock within the proposed project area are approximately 19.1 acres per AUM for a total of approximately 784 AUMs within the project area. Recently, there has been an increase in noxious weeds and a reduction in forage due to short- and long-term disturbances and drought within the project area.

3.10 Cultural Resources

Cultural resources include archaeological, historic, or architectural sites, structures, or places (BLM 2004a). Cultural resources were identified through first conducting a files search of all public land survey system or "legal" sections containing the project area, followed by the

intensive on-the-ground or “Class III” inventory of all cultural resources within a 100-foot-wide corridor along the path of all planned overland vehicle traffic in the project area off of improved surfaces. Visual assessment extended farther for identified intact historic Expansion period road portions and to all site features within 300- and 100-foot corridors for source and receiver operations, respectively, that are considered sensitive to Native American tribes. The sensitive Tolar petroglyphs site was specifically identified for consideration of project source operations within the viewshed up to 0.5 mile with a minimum avoidance of 0.25 mile.

In June 2010, a review of the Wyoming Cultural Resources Information System (WYCRIS) database indicated that 258 previously recorded archaeological and historic sites occur within the greater project area boundaries and those CED locations of the EM survey contained within those bounds. Of the 258 previously recorded sites within the overall project area, 138 are not eligible for National Register of Historic Places (NRHP) nomination; 96 are eligible for NRHP nomination; and 24 are of unevaluated status (and are treated as eligible for NRHP nomination [BLM and Wyoming State Historic Preservation Officer (SHPO) 2006]). The vast majority (87 percent; n = 225) of previously identified cultural resources are prehistoric archaeological sites. Historic sites comprise 10 percent (n = 24), and the remaining 3 percent (n = 9) are multi-component, containing both historic and prehistoric components. While the files search considered all cultural resources located within the project boundary, Class III inventories were limited to federal lands due to denial of access for cultural survey to non-BLM managed lands. The records search was used to provide proper consideration of cultural resources located on non-federal lands.

All CED locations outside of the project area occur on private lands. The file search for the outer CED locations for the EM survey, located outside of the project area, indicated an additional 80 previously recorded archaeological and historic sites within 1 mile of these CED locations. Of these 80 previously recorded sites, 38 are not eligible for NRHP nomination; 20 are eligible for NRHP nomination; and 22 are of unevaluated status regarding eligibility for NRHP nomination. Seventy-eight percent (n = 62) are prehistoric archaeological sites, 14 percent (n = 11) are historic sites, and the remaining 8 percent (n = 7) are multi-component sites, containing both historic and prehistoric components. However, none of the previously recorded cultural resource sites fall within 100 feet of CED locations.

During Class III inventory of federal lands within the project area (SWCA 2010b), only 34 of the 258 previously documented cultural resources were found to intersect the 100-foot-wide corridor of planned overland vehicle traffic. Another seven archaeological sites were newly identified intersecting the 100-foot-wide corridor. Twenty-two of the 265 sites in the project area have features of potential Native American cultural sensitivity. Source lines and travel routes were kept a minimum of 300-feet from these features and receiver lines were kept at least 100-feet away. Due to the importance of the Tolar Petroglyphs to Native American tribes, all source lines were kept a minimum of 0.25 miles, and out of view, from the rock art panels. The Green River RMP (BLM 1997) states that the viewshed within 0.5 mile of the Tolar Petroglyphs be maintained but that some activities may be allowed within 0.5 mile provided they are not visible from, and will not affect, the petroglyphs. Consequently, a viewshed analysis was completed from 5 key observation points and project impacts were analyzed for their effect on the viewshed from the petroglyphs.

Two intact segments of the Overland Trail, the Point of Rocks Stage Station, and the Point of Rocks to South Pass Stage Road also received a minimum 300-foot distance from planned project vehicle travel routes and 100-foot distance from planned receiver lines. Pursuant to the Wyoming Protocol Agreement (BLM and Wyoming SHPO 2006), visual contrast ratings were

conducted for the project at the Tolar petroglyphs site, two intact segments of the Overland Trail, the Point of Rocks Stage Station, and the Point of Rocks to South Pass Stage Road.

Overall, the 22 sites identified to be of potential cultural significance to Native American tribes traditionally affiliated with the greater project area include rock shelters, rock piles, stone circles, rock art, cairns or rock piles, a house pit, and a constructed rock alignment. Among these are the Tolar petroglyphs site and six rock pile/cairn sites on BLM-administered lands, for which tribal consultation has been initiated by the BLM. A field visit by Northern Ute tribal representatives occurred on August 2, 2010. Field visits by the Eastern Shoshone and Northern Arapaho tribal representatives occurred on August 6, 2010, and September 8, 2010, respectively. The Shoshone-Bannock were also contacted but no response was received by the BLM.

3.11 Recreation

Recreation activities available on BLM-administered lands in the project area include hunting, fishing, hiking, dispersed camping, OHV use, sightseeing of historic trails and places, wild horse viewing, wildlife viewing, and photography. The area is expected to receive limited recreational use due to the checkerboard landownership, remoteness, and existing disturbance (i.e., I-80, power plant, and mining). Most recreational activity is expected to occur along Bitter Creek and the Overland Trail, which run along the southern boundary near I-80. Public fishing is available at the Jim Bridger Surge Pond in the northern portion of the project area. Big game hunting areas that overlap the project area include deer Area 131, elk Area 100, and pronghorn Areas 60 and 92.

3.12 Hazardous or Solid Wastes

As defined by the BLM, a hazardous material is any substance, pollutant, or contaminant that is listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The term does not include petroleum products, crude oil, or natural gas. There are no known hazardous or other solid wastes within the project area. No hazardous materials or other solid wastes are known to have been used, stored, disposed of, or otherwise exist within the project area.

3.13 Noise

Noise levels experienced by a receptor depend on the distance between the receptor and the equipment, the topography, vegetation, and meteorological conditions (e.g., wind speed and direction, temperature, humidity). Sensitive noise receptors include wildlife, recreationists, and hunters visiting the area. The EPA established an average 24-hour, day-night sound level (Ldn) noise level of 55 A-weighted decibels (dBA) as a guideline for acceptable environmental noise (EPA 1974). In rural recreational areas, ambient sound levels are expected to be approximately 30 to 40 dBA (EPA 1974; Harris 1991). Median noise levels for the project area likely range from 20 to 40 dBA in the morning and evening and from 50 to 60 dBA in the afternoon when wind speeds are typically greatest. These levels correspond to noise levels of a soft whisper (30 dBA), a library (40 dBA), a quiet office (50 dBA), a small town (40–50 dBA), and normal conversation (60 dBA). Traffic along an interstate typically averages noise levels greater than 70 dBA (BLM 2004b).

The project area is primarily rural and unpopulated. Major industrial noise sources within the project area include the Jim Bridger Power Plant, Jim Bridger Mine, Leucite Hills Mine, and associated vehicular traffic. Noise levels within the working mine area are governed by federal

Mine Safety and Heath Administration (MSHA) occupational noise standards and regulations designed to protect worker safety (30 CFR 62 et seq.). Noise levels from human activity are mostly associated with vehicular traffic. I-80 is the only high-speed road within the vicinity of the project area.

4.0 ENVIRONMENTAL EFFECTS

This section analyses the potential direct and indirect effects (4.1) and cumulative effects (4.2) from the No Action and Proposed Action alternatives, and lists suggested mitigation measures to minimize the effects of the Proposed Action (4.3).

4.1 Direct and Indirect Effects

An environmental impact is defined as a change in the quality or quantity of a given resource as a result of a modification in the existing environment resulting from project-related activities. Beneficial or adverse effects may be a primary result (direct) or secondary result (indirect) of an action and may be permanent and long term or temporary.

4.1.1 Geology

Alternative I – No Action Alternative

Under the No Action Alternative, no impacts to geology would occur. No additional data on subsurface geology would be obtained from geophysical surveys.

Alternative II – Proposed Action

Drill holes for the EM study would only occur to a depth of 4 meters and are not anticipated to affect geological or mineral resources underlying the project area. Other project activities are surficial and would not impact geology. Information obtained from the geophysical exploration and seismic survey would further increase the knowledge and understanding of subsurface geology in this area, especially in regard to the characterization of mineral resources contained within the underlying formations.

4.1.2 Soils

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to soils within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Surface disturbances, including the disturbance of vegetation and topsoil and surface layer compaction, alter primary soil properties that may determine the resistance of soil to erosive forces. Damage and the subsequent loss of vegetation exposes soil to wind and water erosion, while compaction reduces the water holding capacity of soil increasing susceptibility to surface runoff. Degraded and eroded soils ultimately result in the reduction of soil fertility and stability needed for the successful re-establishment of native vegetation. Failure to mitigate impacts on disturbed soil surfaces increases the likelihood of non-native and invasive plant recruitment and downslope sedimentation into streams and other water bodies.

The erodibility of soils within the project area is predominantly low, due to the physical and chemical properties of the soil, along with topography and climate of the project area. Potential impacts to soils in the form of compaction and subsequent erosion could occur, principally by OHV traffic and EM source points. Use of vibroseis buggies off-road could result in temporary (less than one year) effects on soils, such as rutting and compaction. Impacts to vegetation are anticipated to be minimal, especially to forb and grass cover and below-ground roots, thus soil

erosion as a result of vegetation damage and/or loss is anticipated to be negligible. In addition, compaction and soil erosion on level and gently sloping surfaces should to be limited due to stable and well-developed soils; however, traversing areas with relatively steep gullies and terrain could result in increased erosion and soil impacts. Soils in the project area most sensitive to erosion are those occurring on steep slopes (greater than 25 percent), where sparsely vegetated and shallow, moderately erodible soils (fine-loamy, mixed, frigid) typically occur.

Actions taken to protect soils from erosive forces and further degradation ultimately conserve soil productivity and fertility, providing optimal conditions for plant growth to sustain wildlife habitat, air and water quality, and a viable agricultural economy (Urbigkit 2008). To protect the soil resource, existing BLM standards limit surface disturbance on slopes greater than 25 percent. With implementation of slope restrictions, the project should cause minimal impacts. Impacts to soils may also occur as a result of surface rutting caused by vehicle operations on saturated soils. Existing BLM standards call for closure during such conditions.

4.1.3 Vegetation and Noxious Weeds

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to vegetation within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Impacts to vegetation include the increased potential for non-native/noxious plant establishment and introduction, accelerated wind and water erosion, changes in water runoff due to road deterioration from increased traffic, soil impacts that affect plant growth (soil erosion or siltation), shifts in species composition and/or changes in vegetative density away from desirable conditions, airborne dust on roadside vegetation, and changes in visual aesthetics, especially if vegetation becomes covered with dust created by operations. There may be temporary impacts to native vegetation during seismic activities. OHV activity could result in temporary to short-term (less than three years) impacts to vegetation from vehicle tracking and compression, breaking, or crushing of woody shrub species. OHV use can result in long-term vegetation impact (mortality) to sagebrush particularly if this activity occurs during a prolonged dry period. Vehicle impacts to grasses and forbs are anticipated to be short term since these species are not killed and would re-sprout from their established root systems. Compaction of vegetation and a minor loss of aerial coverage also would be expected at EM source points.

Where soils are disturbed and native vegetation is lost, the likelihood for non-native or invasive species to be introduced and become established is increased. Direct impacts to vegetation from weed infestations in the project area may reduce structural and native species diversity, result in the loss of wildlife habitat, result in the loss of rangeland productivity, and reduce cover of desirable species. On-road vehicle and OHV activity within the project area could introduce and/or spread undesirable plant species, which could lead to reduced amounts of desired species. Indirect impacts resulting from weed infestations in the project area would include changes in the fire cycle and increased economic costs from weed management efforts.

4.1.4 Water Resources

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to water resources within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Surface Water, Wetlands, and Riparian Habitat

The project area is within the Upper Green River watershed and under the guidance of the BLM Green River RMP (BLM 1997). Watershed management objectives in the Green River RMP emphasize 1) stabilize and conserve soils; 2) increase vegetative production; 3) maintain or improve surface water and groundwater quality; and 4) protect, maintain, and improve wetlands floodplains and riparian areas (BLM 1997). Based on the RMP, the Town of Superior aquifer recharge area will be managed to protect groundwater quality and activities will only be allowed if groundwater quality will be protected (BLM 1997). Other management guidelines include EO 11988 Floodplain Management and E.O. 11990 Protection of Wetlands. Existing land use activities in the area that potentially affect water resources include coal development and other mining, oil and gas exploration and production, livestock grazing, unimproved and improved roads, OHV use, and other activities that may result in surface disturbances in aquifer recharge areas and directly in aquatic and riparian areas.

For the purpose of this evaluation, impacts to surface water resources includes direct impacts resulting from tracking vibroseis buggies across wetland and riparian areas, and EM operations, specifically the drilling of 4-meter-deep EM source points within areas of surface water resources or in the Superior aquifer recharge area. Direct impacts to surface water resources include the removal of vegetation in aquifer recharge zones which may hinder percolation and infiltration rates. Indirect impacts resulting from vegetation removal include increased erosion and runoff potentials, decreased infiltration rates for groundwater recharge, and decreased water quality and inflated TDS concentrations resulting from storm water runoff from disturbed areas. Geo has committed to avoiding rivers, primary intermittent streams, and wetlands whenever possible during project activities. Due to the minor amount of anticipated surface disturbances and limited removal of vegetation, the proposed action would not result in significant impacts to surface water resources assuming the proposed mitigation measures outlined in Section 4.3 are implemented.

Groundwater

Due to the nature of the proposed activity, impacts to groundwater resources are expected to be minimal. Groundwater resources are expected to be located below 4 meters from the surface. Shallow water tables and deeper confined aquifers are not expected to be encountered during boring of the 4-meter-deep EM source points or other project activities. Indirect impacts to groundwater resources may result from the surface disturbance around EM source points and the inadvertent removal of vegetation during vibroseis operations. The compaction of vegetation and loss of aerial coverage is expected to be minimal and limited to source points and EM source points. Soil compaction and decreased percolation rates due to minor surface disturbances in the Town of Superior aquifer recharge area are expected to be limited to source points, and the 4-meter-deep EM source points. Soil amendments and water used to backfill the EM source points would have a minimal effect on percolation rates due to the small diameter of drilled source points and minimal surface disturbances relative to the entire recharge area. To

further minimize the potential for impacts to waters resources, groundwater and surface water mitigation measures should be implemented (see Section 4.3).

4.1.5 Wildlife

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to wildlife species within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Impacts to most wildlife species would consist of a temporary loss of habitat used for foraging, nesting, and cover; temporary disturbance or displacement; and direct mortality. Impacts would be minimized by scheduling project activities for the fall, outside of crucial wintering and nesting/breeding seasons. Due to the short duration of the project, wildlife disturbance and displacement would be short term and impacts are expected to be negligible. Some direct mortality may occur to herptiles or small mammals that are unable to move away from trucks, buggies, or ATVs. However, off-road vehicle speeds are slow and the probability of vehicle strikes of wildlife species is low. Some wildlife is likely to disperse during activities when disturbed by noise, vibrations, and human presence. Dispersing individuals would avoid direct impacts from project activities but could be affected by increased stress and become more vulnerable to predation. Individuals that stay in burrows could be affected by vibrations and EM currents delivered into the ground. However, the EM study would deliver a current of 160 amps into the ground, which is relatively low (in comparison, a lightning strike delivers 30,000 amps on average [Funk 2003]) and not expected to impact fossorial wildlife. Seismic vibrations assumingly could cause some burrows within the path of buggies to collapse, although this has not been documented.

Although no studies on the effects of EM currents on terrestrial wildlife were found, studies have noted the impacts of EM on marine wildlife. Marine wildlife (invertebrates, fish, birds, sea turtles, marine mammals) in the immediate vicinity (50 km^2) may detect an EM source, but the maximum duration of potential effect for any one point is very short and any effects should be quickly reversible (C-NLOPB 2006). Effects on health and behavior from marine EM currents were expected to be none to negligible and not significant due to the low frequency and short duration. It is assumed that effects on terrestrial wildlife would also be negligible. Chickens have been observed touching EM survey electrodes without getting harmed (EMTek no date).

Big game would likely move out of the project area during seismic and EM activity, but return soon after. In a Wyoming study, elk were not seen within 0.5 mile during seismic vibrator activity, although several were observed within 0.5 mile within a week before and after (Ward 1984, 1986). During seismic drilling and shot activity, most elk were observed at least 2 miles away, but were seen within 1 mile a few weeks later. Elk were most affected by people walking and moved out of sight of seismic crews. Elk in this study did not appear to suffer any detrimental effects other than expending extra energy to move away from seismic activity.

4.1.6 Special Status Species

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to special status species within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Threatened and Endangered Species

Impacts to prairie dogs and their burrows may indirectly affect black-footed ferret due to loss of habitat and prey. Seismic vibroseis activity could cause some burrows to collapse, however prairie dog populations and habitat would persist in the area. The BLM would enforce a 50-foot No Surface Occupancy (NSO) stipulation around active prairie dog towns to minimize impacts to this habitat. Therefore, no impacts to black-footed ferrets or their habitat are anticipated.

Any direct impacts to prairie dog towns would impact suitable mountain plover habitat; however, the BLM would enforce a 50-foot NSO stipulation around active prairie dog towns which would protect plover habitat. Impacts to other suitable habitat (e.g., grazed areas) would also temporarily impact potential mountain plover habitat. Project activities are scheduled for after the nesting season and mountain plovers may have begun migrating out of the area to wintering grounds. Therefore, no direct impacts to mountain plovers or their nests are expected. Should project activities be delayed into nesting season, surveys would be conducted in suitable habitat and occupied habitat would be avoided.

Project activities located in or near greater sage-grouse nesting/brood-rearing habitat and winter habitat could negatively affect sage-grouse due to noise, human presence, and crushing of vegetation. The degree of impact on greater sage-grouse would depend on the proximity of the activities to occupied habitat and the amount of habitat that would be affected. The closest lek is approximately 3 miles from the project area and no impacts to leks are anticipated. Some of the 3,543 acres of nesting/brood-rearing habitat (land within 4 miles of leks) within the project area would be affected during project activities. Potential impacts could include nest abandonment, dispersion of individuals from preferred habitat, and mortality from vehicle collisions. However, activities are scheduled for the fall, after the breeding/nesting season. No direct impacts to wintering grouse are anticipated. Wintering grouse to the north of the project area may be temporarily disturbed by project noise, particularly if helicopters fly over this area. Long-term impacts could be associated with habitat degradation due to crushing of sagebrush. Therefore, the project may affect, but would not adversely affect greater sage-grouse.

If unidentified populations of Ute ladies'-tresses are present, individual plants could be crushed by project activities. Potential Ute ladies'-tresses habitat along Bitter Creek was surveyed and no populations were found. Geo has committed to avoiding rivers, primary intermittent streams, and wetlands to the extent possible during project activities; and no impacts to Ute ladies'-tresses are anticipated.

BLM Sensitive Species

Project activities would not impact the prey base (e.g., insects) or roosting areas of Townsend's big-eared bat and spotted bat. If bats are flushed from roost sites, they would likely return following the completion of daily project activities. Therefore, the Proposed Action may impact individual sensitive bats over the short term, but would not contribute to federal listing.

Pygmy rabbits and prairie dogs are likely to disperse to avoid direct impacts from project activities. Dispersing individuals could be affected by increased stress and could become more vulnerable to predation. Individuals that stay in burrows could be affected by seismic vibrations and EM currents delivered into the ground. However, the EM study would deliver a current of 160 amps into the ground, which is relatively low and not expected to impact fossorial wildlife (see Wildlife section). Seismic vibrations near pygmy rabbit, white-tailed prairie dog, and Wyoming pocket gopher habitat could cause burrows in the immediate vicinity to collapse. The BLM would enforce a 50-foot NSO around active prairie dog towns and active pygmy rabbit burrows to minimize impacts to these species. This would also protect other sensitive species that use prairie dog habitat from potential impacts (e.g., mountain plover, burrowing owl). No Wyoming pocket gopher burrows were found within the project area and would not be impacted. The crushing of sagebrush habitat would impact pygmy rabbit by degrading its habitat. Pygmy rabbits need stands of relatively taller and denser sagebrush than the surrounding habitat.

Seismic activities could disturb nesting sensitive bird species if these activities occur during the nesting period; however, activities are scheduled for the fall when birds are no longer nesting or have migrated out of the area. Therefore, no impacts to nesting birds would occur. Impacts from the short-term loss of vegetation important to ground- and shrub-nesting birds would be negligible since seismic activities would crush, but not remove, vegetation. The Proposed Action would have short-term effects on nesting migratory birds or their habitats, and would not result in the decline of local subpopulations or populations as a whole.

All rivers, primary intermittent streams, and wetlands would be avoided; therefore, the proposed seismic project is not likely to have a negative impact on northern leopard frog or breeding Great Basin spadefoot toad. Individual spadefoot toads in uplands may be impacted by vehicles.

No sensitive plants or suitable sensitive plant habitat were observed within the project area. Therefore no impacts to sensitive plants are anticipated.

4.1.7 Livestock Grazing

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to grazing within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Leaving fences down or gates open when livestock are present might result in livestock moving between pastures or allotments, from private or state to public land or vice versa, onto highways, and herds mixing. This could lead to unauthorized grazing, overgrazing, or increased livestock operator cost associated with sorting mixed herds, and increased risk of vehicle collisions. Seismic operations near water wells and pipelines or water impoundments might result in casing failure and a subsequent loss of livestock water. Heavy vehicle traffic could damage existing cattle guards. All surface-disturbing activities associated with the Proposed Action would result in a temporary crushing of vegetation and soils, but no long-term impacts to livestock forage are expected. This disturbance would consist primarily of conversion of the mature shrubs and forbs in the tire paths to grass and to younger, more succulent shrubs and forbs. While species and age composition of plants in the tire paths would change, available palatable livestock forage would not be appreciably affected.

4.1.8 Cultural Resources

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to cultural resources within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

The proposed seismic exploration could affect sites that are eligible for listing on the NRHP, or sites that are unevaluated for NRHP eligibility which are treated in the same manner as historic properties under the Wyoming Protocol Agreement (BLM and Wyoming SHPO 2006). An effect is defined as an alteration to the characteristics of an historic property qualifying it for inclusion in or eligibility for the NRHP (43 CFR 800.16[i]). These effects could primarily occur in the form of direct and indirect impacts in relation to the proposed geophysical exploration project. "Historic properties" are only those cultural resources considered eligible for NRHP nomination. Those cultural resources whose eligibility has not been evaluated will be managed in the same manner as eligible properties. Cultural resources considered not eligible for NRHP nomination may be impacted by project actions, but impacts to "not eligible" cultural resources are not considered significant.

Direct impacts are physical impacts that can cause adverse effects to the site or its setting. Direct impacts could occur from vehicle traffic through sites during geophysical field operations, creating two-track roads, surface soil displacement, and/or soil compaction. If exploration activities are conducted in wet weather, rutting could also occur within sites. The new trails, themselves a direct impact, could also affect the setting of sites for which setting is a component of site significance. Indirect effects to sites could occur through creation of trails, which subsequently might be used for access by recreationists and which may increase erosion. By providing access into areas containing sites, these paths could lead to increased visitation and damage to the resources by the public, and/or illegal collection of artifacts.

The project area of potential effect (APE) for cultural resources is defined as being within 100 feet of the path of project vehicle travel off of improved surfaces. The APE also includes areas where source operations/routes occur within 300 feet (at least 0.25 mile or viewshed up to 0.5 mile for the Tolar petroglyphs site) or receiver operations/lines within 100 feet of the integral setting or viewshed of sites sensitive to Native American tribes or Expansion period wagon roads. The APE also includes 11 of the 21 receiver lines, which were inventoried for cultural resources as these 11 lines may be subject to vehicle access. The remaining 10 receiver lines, to be hand laid by persons on foot with helicopter support and not proposed for vehicle access, are considered to be of no potential impact to cultural resources. Standard BLM procedures, including H-3150-1 requirements (BLM 2007a), provide for avoidance of adverse effects to significant cultural resources through geophysical project redesign removing the APE away from these resources.

All sites eligible or unevaluated for NRHP nomination within the project area and those CED locations of the EM survey both within and outside of the project area were avoided by a minimum of 100 feet by all project vehicle traffic off of improved roads—300 feet if tribally sensitive site types or intact portions of Expansion period wagon roads and a minimum of 0.25 mile or visual horizon up to 0.5 mile for the Tolar petroglyphs site. Additionally, receiver lines were moved a minimum of 100-feet from tribally sensitive site types and intact portions of Expansion period wagon roads. All source or receiver points and access routes that in initial

project design layouts were not already at or farther than these minimum distances from these NRHP-eligible or unevaluated sites were relocated on the ground by project surveyors during final project design to establish the appropriate minimum distance between the site location and the proposed source or receiver points and access route on all project lands, federal or non-federal.

The entire proposed project lies within the boundary of a Memorandum of Agreement between the BLM, Wyoming SHPO, and Oregon-California Trails Association regarding the Management of the Historic Trail Settings of the Overland Trail and Point of Rocks to South Pass Stage Road (BLM 2007b). That agreement determined that the viewshed from the Overland Trail and the Point of Rocks to South Pass Stage Road in the MOA area has been compromised by modern intrusions. As an added precaution, visual contrast rating assessments were used to confirm the potential for project impacts to the viewshed of the Tolar petroglyphs site, the Point of Rocks Stage Station on the Overland Trail, two segments of the Overland Trail, and the Point of Rocks to South Pass Stage Road. These assessments confirmed that project avoidance measures will result in no visual contrast or a weak visual contrast (as defined by BLM and Wyoming SHPO 2006) in relation to the pre-existing setting of these sites. To further achieve this objective, off-road source operations traffic approaching within 0.25 mile of the historic Overland Trail segments (the Point of Rocks Stage Station and the Point of Rocks to South Pass Stage Road) will drive a sinuous path along the contour of the existing landform to avoid creating straight lines or paths through the brush vegetation visible from the historic site(s) in contrast to the surrounding landscape.

With these project avoidances implemented, the Proposed Action will result in no effects to historic properties or otherwise sensitive cultural resources or their integral settings.

4.1.9 Recreation

Alternative I – No Action Alternative

Under the No Action Alternative, impacts to recreation within the project area would continue at existing levels without any additional impacts that may result from the proposed geophysical activity.

Alternative II – Proposed Action

Project activities could temporarily disrupt recreational activities due to increased visual disturbance, human activity, equipment, and noise (i.e., drilling, and helicopters) in the project area. Project impacts on dispersed recreation are anticipated to be short term and minimal. Increased vehicle traffic and human presence could decrease the experience of recreationists seeking solitude. However, the project area is bisected by an interstate highway and contains an active power plant, so the change in the recreational setting would not be significant. Big game may be temporarily displaced to areas outside the project area. Project activity and displaced big game could inconvenience hunters should project operations overlap with hunting seasons (September 1–November 1). No impacts to recreation would occur following completion of the project. Overall, impacts to recreation are considered less than significant.

4.1.10 4.1.11 Hazardous or Solid Wastes

Alternative I – No Action Alternative

No hazardous or solid wastes would be generated or managed under the No Action Alternative.

Alternative II – Proposed Action

Under the Proposed Action, typical lubricants and fuels important to implement seismic exploration would be used. However, no listed hazardous or other solid waste beyond the CERCLA standards would be used within the project area. In addition, any fuels and other potentially hazardous materials would be stored off site on private lands. No hazardous materials would be used for the EM study. During activities, materials such as trash and other discarded items may accumulate in the project area due to human presence. This includes stakes and flagging, as these are used to delineate a particular area for seismic activity.

4.1.11 Noise

Alternative I – No Action Alternative

Under the No Action Alternative, no noise-increasing operations would occur. Therefore, there would be no change to existing conditions, and no potential noise-related impacts to area wildlife and human visitors.

Alternative II – Proposed Action

Noise from geophysical exploration operations would be associated with helicopter use, vibroseis buggies, EM drilling operations, vehicle traffic, and human activity. Of these, the helicopter noise has the potential to cause the greatest disturbance to recreationists (i.e., hunters) and to wildlife. These noises would be transient as the project operations proceed across the project area, but would occur for the duration of the project (approximately four months). The noise level would diminish considerably a short distance away from the project operations. The absolute noise level is not expected to exceed the 55-dBA level except for brief periods and then only if the recreationist is in close proximity (less than 1 mile) from the operations or near the helicopter flight path. However, it is the relative change from background to project level noise that is likely to be of concern.

Tests by the Federal Aviation Administration on helicopters comparable to the ones used for seismic operations indicate 70 to 80 dBA levels at usual air speed and 1,500-foot flyover altitudes directly underneath the helicopter (BLM 2005). Helicopter noise would occur over much of the project area, but would be focused primarily along flight paths, staging areas, and EM drilling locations. Only one helicopter at a time is expected for the project, which would lessen overall noise impacts. Noise related to drilling would occur over most of the project duration. Vehicle traffic noise would be of a limited extent and not create noise levels substantially over current noise levels. Most of the traffic would be from light trucks and ATVs. Direct human noise would be very limited and disturbance from workers to animals in the immediate vicinity would not likely impact wildlife or recreationists, except over the short term.

The response and impacts from noise to wildlife is extremely varied and general conclusions about the type and magnitude are difficult to reach (Larkin 1996). Project-related noise may cause individuals or groups of animals to seek shelter or temporarily flee the immediate area of activity and move to adjacent suitable habitat. However, wildlife displacement would be expected to be brief and localized, as activities are concentrated in limited areas at any one time, the activity is fast moving, and the duration in any one area is short term.

4.2 Cumulative Effects

The BLM must consider the cumulative effects of the Proposed Action in conjunction with other activities. A cumulative impact is an impact on the environment that results from the incremental

impact of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Past and present major land uses within and adjacent to the project area include livestock grazing, mineral development, and recreation. Existing disturbance and activities associated with the adjacent Jim Bridger Power Plant are also located within the project area. This includes surface and underground coal mines, power plant facilities, and evaporation ponds; conveyer belt; railroad tracks; roads; oil and gas wells and associated pad, road, and pipeline facilities; and transmission lines.

The proposed 3-D geophysical seismic exploration and the EM study would not significantly contribute incrementally to long-term changes to the major resources identified in this EA. Any potential adverse long-term cumulative effects of the Proposed Action have been adequately mitigated through project design, applicant-committed environmental protection measures, and additional mitigation measures recommended.

Reasonably foreseeable future actions include oil and gas development. The 3-D geophysical seismic exploration and the EM study also contribute beneficial impacts by reducing adverse effects on resources over the long term if future oil and gas exploration and development were to occur. Little data are currently available to determine the potential success ratio of wells to develop oil and gas resources in the project area. Geophysical data collected could reduce the number of exploratory and development wells necessary to extract oil and gas resources with a higher success ratio. Fewer wells would result in the long-term reduction in potential disturbances to area resources, activities, and users from well pads, roads, and other ancillary facilities.

4.3 Mitigation Measures

The following mitigation measures will be employed to avoid or reduce potentially significant effects. Monitoring would be required to ensure the implementation of these measures.

4.3.1 Vegetation and Noxious Weeds

- Reclaim all surface disturbances using a BLM-approved seed mixture.
- Ensure vehicles and equipment are cleaned, power-washed, and free of soil and vegetation debris prior to entry and use of access roads to prevent transporting weed seeds.
- Ensure all seed mixtures, erosion control materials, and reclamation materials are certified weed free.

4.3.2 Water Resources

- Reclaim all surface disturbances within the Town of Superior aquifer recharge zone.
- Seed disturbed areas in the Town of Superior aquifer recharge zone for the 17 EM points.
- Limit vegetation removal, OHV usage, and surface disturbances to the smallest area necessary to conduct work within the Superior aquifer recharge area.

- If avoiding wetland areas is not possible, allow vibroseis buggies to pass only one way in wetland areas to avoid rutting and unnecessary surface disturbances of vegetation and the upper soil layer in wetlands and riparian areas.
- Conduct work during drier months and low-flow conditions in perennial and intermittent streams.

4.3.3 Wildlife and Sensitive Species

- Avoid active prairie dog burrows and active pygmy rabbit burrows by 50 feet.
- Project activities are scheduled to avoid wildlife conflicts; however, if the schedule changes, the following seasonal restrictions would be enforced:
    - Avoid pronghorn and mule deer crucial range November 15 through April 30.
    - Avoid greater sage-grouse nesting areas March 15 through July 15.
    - Avoid areas of high probability for mountain plover habitat or conduct nest survey and avoid active nesting April 10 through July 10.
    - Survey for burrowing owls if project activities occur between April 1 and September 10.
    - Avoid all active raptor nests by 0.5 mile (1.0 mile for ferruginous hawk) February 1 through July 31.

4.3.4 Noise and Safety

- The Operator should keep all noise levels at a minimum where vehicles are not used extensively for unnecessary travel or near the town of Point of Rocks, especially between 9:00 PM and 8:00 AM.
- No firearms would be allowed in the project area at anytime.
- No smoking would be allowed outside of vehicles to reduce fire hazards.
- An emergency response plan would be in place to address fire, injuries, and other potential hazards.

4.3.5 Hazardous or Solid Wastes

- After seismic activities cease, the Operator would collect and properly dispose of all waste generated by this project at an approved waste disposal site.
- The Operator would submit its Spill Prevention Containment and Countermeasure (SPCC) Plan to the authorized officer prior to scheduled start-up. If the Operator encounters any waste dump sites on or adjacent to the project area, they must be reported to the BLM.
- All refueling would occur on existing roads and absorbent pads would be used while refueling to prevent a potential fuel spill. In the event of a spill of lubricants, hydraulic fluid, or any other hydrocarbon during seismic activities, the Operator would immediately cease activities within the area and contain and clean up the affected area immediately. Any contaminated vegetation and soil would be removed and disposed of in an approved waste disposal facility. The Operator would have absorbent onsite for spill containment. After cleanup is complete, the spilt substance(s) and materials used for

cleanup would be removed from the project area and disposed of at an approved disposal facility. All spills would be immediately reported to the BLM.

4.4 Residual Effects

Mitigation measures would avoid or minimize most project impacts. There would be minor residual effects to vegetation where plants or branches have been crushed. No other residual effects are expected.

5.0 TRIBES, INDIVIDUALS, ORGANIZATIONS, OR AGENCIES CONSULTED

Representatives from the BLM, Northern Ute Tribe, and SWCA attended a field meeting on August 2, 2010. During the meeting, five sensitive cultural sites in the project area were visited.

6.0 LIST OF PREPARERS

The BLM Interdisciplinary Team and the consultant Interdisciplinary Team that were principally involved in preparing this EA are listed below.

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- Andrew Smith – Natural Resource Specialist
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6.1 List of Reviewers

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7.0 REFERENCES

Bureau of Land Management (BLM). 1997. The Green River Resource Management Plan. Rock Springs Field Office.

———. 2002. PacifiCorp Jim Bridger Power Plant Flue Pond Expansion Environmental Assessment. March 8, 2002.

———. 2004a. Glossary. In *8100 – The Foundations for Managing Cultural Resources*. Available online at http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies/cr_publications.Par.44865.File.dat/Binder2-2.pdf. Accessed August 17, 2010.

———. 2004b. Environmental Assessment for the Proposed Ten Mile Coal Lease-By-Application and Associated Rights-of-Way, Sweetwater County, Wyoming. June 2004.

———. 2005. Clark 3-D Geophysical Survey Environmental Assessment. U.S. Department of the Interior, Bureau of Land Management Cody Field Office. December 2005.

———. 2007a. H-3150-1 Onshore Oil and Gas Geophysical Exploration Surface Management Requirements. Available online at http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.82968.File.dat/h3150-1.pdf. Accessed June 23, 2010.

———. 2007b. Memorandum of Agreement Among the Bureau of Land Management, Wyoming State Historic Preservation Officer, and Oregon-California Trails Association Regarding the Management of Historic Trial Settings of the Overland Trail and Point of Rocks to South Pass Stage Road in the Vicinity of the Bridger Coal Company Mine and Power Plant, in Sweetwater County, Wyoming.

———. 2008. Record of Decision and Approved Pinedale Resource Management Plan. Available online at http://www.blm.gov/rmp/wy/pinedale/documents.html. Accessed June 2010.

———. 2010a. BLM Wyoming Sensitive Species Policy and List. March 31, 2010.

———. 2010b. BLM Wyoming Instruction Memorandum No. WY-2010-012. December 29, 2009. "Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management Administered Public Lands including the Federal Mineral Estate."

———. 2010c. BLM Wyoming. Carrie Nelson, Wildlife Biologist, Bureau of Land Management, Rock Springs Field Office. Personal communication with K. Altvater, SWCA Natural Resource Specialist. August 5, 2010.

———. 2010d. BLM Wyoming. Glennon, Jim, Botanist. High Desert District, Bureau of Land Management, Wyoming. Personal communication with C. Baker, SWCA Biologist, June 6, 2010.

———. 2010e. BLM Wyoming. Mastny, Cherette. Rangeland Management Specialist, Bureau of Land Management, Rock Springs Field Office. Personal communication with Adrian Hogel, SWCA Biologist, July 15, 2010.

Bureau of Land Management (BLM) and Wyoming State Historic Preservation Officer (SHPO). 2006. Programmatic Agreement among the Bureau of Land Management, Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in which BLM Will Meet its Responsibilities under the National Historic Preservation Act State: Protocol between the Wyoming

Bureau of Land Management State Director and the Wyoming State Historic Preservation Officer. Available online at http://wyoshpo.state.wy.us/pdf/ProtocolFinal.pdf. Accessed June 24, 2010.

Bridger Coal Company. 2009. WDEQ Annual Report. 2009 Wildlife Monitoring Data.

Chapman, S.S., S.A. Bryce, J.M. Omernik, D.G. Despain, J. ZumBerge, and M. Conrad. 2004. Ecoregions of Wyoming. Reston, VA: U.S. Geological Survey.

C-NLOPB. 2006. Orphan Basin Controlled Source Electromagnetic Survey Program Environmental Assessment. Available online at http://www.cnlopb.nl.ca/environment/obelectr.shtml. Accessed August 9, 2010.

Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 131pp.

EMTek. No Date. Environmental impact of land EM work using a grounded transmitter. PowerPoint presentation.

Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. EPA-550/9-74-004.

Funk, T. 2003. Lightning: Facts, Fiction, Safety Issues, Lightning Formation, Meteorological Considerations. National Weather Service, Louisville, KY. Available online at http://www.crh.noaa.gov/lmk/soo/presentations/Lightning_WFO_LMK.pdf. Accessed August 13, 2010.

Fertig, W., R. Black, and P. Wolken. 2005. Rangewide status review of Ute ladies'-tresses (*Spiranthes diluvialis*). Prepared for the U.S. Fish and Wildlife Service and Central Utah Water Conservancy District.

Green, G., and P.M. Drouillard. 1994. Wyoming digital geologic map: U.S. Geological Survey Open-File Report 94-0425, scale 1:250,000.

Harris, C.M. 1991. Handbook of Acoustical Measurements and Noise Control, McGraw-Hill, Inc., New York, New York.

Holloran, M.J., and S.H. Anderson. 2005. Spatial distribution of greater sage-grouse nests in relatively contiguous sagebrush habitats. Condor 107:742–752.

Holloran, M.J., R.C. Kaiser, and W.A. Hubert. 2007. Population Response of Yearling Greater Sage-Grouse to the Infrastructure of Natural Gas Fields in Southwestern Wyoming. U.S. Geological Survey and Wyoming Cooperative Fish and Wildlife Research Unit. Laramie, Wyoming.

Larkin, R.P. 1996. Effects of military noise on wildlife: a literature review. Center for Wildlife Ecology, Illinois Natural History Survey, Champaign, Illinois.

Martner, B.E. 1986. Wyoming climate atlas. Lincoln, University of Nebraska Press, 432 pages.

Munn, L.C., and C.S. Arneson. 1998. Draft Wyoming Estimated Net Annual Aquifer Recharge, University of Wyoming Spatial Data and Visualization Center, Laramie, WY.

SWCA Environmental Consultants (SWCA). 2010a. Rare Plant Habitat Model for the Bridger 3D Seismic Survey, Sweetwater County, Wyoming. Prepared for the BLM Rock Springs Field Office. July 1, 2010.

———. 2010b. Class III Cultural Resources Inventory of the Jim Bridger 3-D Geophysical Exploration Project, Sweetwater County, Wyoming. Report on file with the BLM Rock Springs Field Office, Wyoming.

Tetra Tech. 2008. Leucite Permit Wildlife Monitoring Map. Leucite Hills Mine.

Urbigkit, C. 2008. Sublette County Federal and State Land Use Policy draft 6/18/08. Sublette County Commission, Pinedale Wyoming. 36 pages.

U.S. Fish and Wildlife Service (USFWS). 2010. Endangered Species by County. Available online at http://www.fws.gov/endangered/. Accessed July 13, 2010.

U.S. Geological Survey (USGS). 2005. Water Resources of Sweetwater County, Wyoming. Scientific Investigations Report 2004-5214. Available online at http://pubs.usgs.gov/sir/2004/5214/pdf/sir20045214.pdf. Accessed August 3, 2010.

———. 2006. The National Map LANDFIRE. Available online at http://landfire.cr.usgs.gov/viewer/viewer.htm. Accessed July 2010.

Ward, A.L. 1984. The Response of Elk to Seismic Activity in the Little Snake River Known Recoverable Coal Resource Area of Southcentral Wyoming. Rocky Mountain Forest and Range Experiment Center. Laramie, WY.

———. 1986. Displacement of Elk Related to Seismograph Activity in South-central Wyoming. Pages 246-254 in Proceedings II: Issues and Technology in the Management of Impacted Western Wildlife. Thorne Ecological Institute, Glenwood Springs, CO.

Wyoming Department of Environmental Quality (WDEQ). 2010. Water Quality Division Surface Water Standards. Available online at http://deq.state.wy.us/wqd/watershed/surfacestandards/index.asp. Accessed August 3, 2010.

Wyoming Game and Fish Department (WGFD). 2009. GIS data for the locations of greater sage-grouse leks in Wyoming.

Wyoming Natural Diversity Database (WYNDD). 2010. Wyoming Natural Diversity Database Biologist Comments for the Bridger EA Project Area and 4-mile Buffer. Reviewed by J. Handley and D. Keinath.

Wyoming State Engineer's Office (WSEO). 2010. Wyoming well permit data. Available online at ftp://seoftp.wyo.gov/wells/wells06.zip. Accessed August 9, 2010.

Wyoming Weed and Pest Council. 2010. Weed and Pest Declared List (By County) Amended February 2010. Available online at http://www.wyoweed.org/Documents/DocumentPage/2010%20Declared%20List.pdf. Accessed August 6, 2010.