3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter is a summary of the affected environment for all resources potentially impacted by the Proposed Action. These resources are addressed based on management issues identified by the BLM, Great Divide Resource Management Plan, public scoping, and by interdisciplinary desktop and field analysis of the JRPA.

The Proposed Action could potentially affect critical elements of the human environment as listed in the BLM National Environmental Policy Act Handbook H-1790-1 (BLM 1988). Critical elements of the human environment, their status in the JRPA, and the potential to be affected by the Proposed Action are identified in **Table 3-1**. The items listed as none present will not be addressed in the EA because they would not be affected by the Proposed Action or the No Action Alternative.

Table 3-1
Elements of the Human Environment, Jolly Roger Project Carbon County, Wyoming, 2004

Element	Status in JRPA	Addressed in EA
Geology/Minerals/Paleontology	Potentially affected	Yes
Climate and Air Quality	Potentially affected	Yes
Cultural Resources	Potentially affected	Yes
Water Resources (surface and groundwater)	Potentially affected	Yes
Wildlife/Fisheries (Federally threatened/endangered, and sensitive species)	Potentially affected	Yes
Range Resources/Land Use	Potentially affected	Yes
Vegetation (including wetlands/riparian, noxious weeds)	Potentially affected	Yes
Recreation	Potentially affected	Yes
Visual Resources	Potentially affected	Yes
Socioeconomics	Potentially affected	Yes
Transportation	Potentially affected	Yes
Native American Religious Concerns	Potentially affected	Yes
Noise	Potentially affected	Yes
Hazardous or Solid Waste	Potentially affected	Yes
Soils	Potentially affected	Yes
Health and Safety	Potentially affected	Yes
Floodplains	None present	No
Wild and Scenic Rivers	None present	No
Wilderness	None present	No
Environmental Justice	None present	No
Areas of Critical Environmental Concern	None present	No
Prime and Unique Farmland	None present	No

3.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

3.2.1 Physiography, Topography, and Landforms

The JRPA is located within the Great Divide Basin. Elevations in the JRPA range from 6,500 to 7,000 feet. The Great Divide Basin is bordered by branches of the Continental Divide and has no external outlet. None of the precipitation falling within the basin leaves through surface flow and there is no known groundwater discharge from the basin.

3.2.2 Geology

The Great Divide Basin is a sub-basin of the Greater Green River Basin, which consists of a complex series of basins separated by uplifts and ridges. During the late Cretaceous and early Tertiary Periods, eroding sediments from the surrounding highlands and mountains filled the Greater Green River Basin as it began to develop approximately 70 million years ago. The JRPA is located within the southeastern portion of the Great Divide Basin.

During most of the Late Cretaceous Period, the basin was beneath a relatively shallow epicontinental sea that extended from the Atlantic Ocean to the Gulf of Mexico. Four major transgressive-regressive cycles of this epicontinental sea have been recorded from the Middle Albian to the Middle Maestrictitian Period. By the middle of the early Maestrichian Period, the sea had retreated from south-central Wyoming.

The Upper Cretaceous Lance Formation underlies the JRPA and consists of sandstone, dark-gray or brown shale, coal, and lignite. This formation is underlain by the Lewis Shale and Fox Hills formations of the late Cretaceous Period. The Lewis Shale and Fox Hills formations were deposited during the final retreat of the epicontinental seas from the western interior. Exposures of the Lewis Shale and Fox Hills Formation occur along the eastern margin of the Great Divide and Washakie Basin. Lewis Shale is underlain by the Almond Formation, which consists of sandstone, siltstone, carbonaceous shale, and coal. In addition to the Almond formation, several other members of the Mesaverde Group (Allen Ridge, Pine Ridge) yield thin coal seams that exhibit potential for natural gas production.

Jolly Roger Project Area Coalbed Natural Gas Producing Formations

JRPA drilling intends to produce natural gas from coal, carbonaceous shale, and sandstone of the Mesaverde Group, including the Almond, Pine Ridge, and Allen Ridge Formations. The primary producing coals in other exploration pilot projects in the ARPA occur in the Pine Ridge and Allen Ridge Formations. Coal, sandstone, and carbonaceous shale within the Haystack Mountain Formation may also be tested for natural gas in the JRPA (Dewey 2004).

The Almond Formation contains three to nine individual coal beds interbedded with carbonaceous shale and sandstone. These coal beds have good lateral continuity. The average net coal thickness ranges between 4-10 feet, and locally reaches thicknesses greater than 15 feet. The sandstone beds range in thickness of between 2-8 feet. Individual sandstone beds may vary in thickness, but they appear to be laterally continuous. Porosity within the Almond sandstones ranges between 4-20 percent.

The Pine Ridge contains six to nine individual coal beds. Average net coal thickness for the Pine Ridge varies between 10-25 feet, and locally reaches thicknesses greater than 40 feet. Pine Ridge sandstone beds range in thickness of between 2-10 feet. Porosity within these sandstones varies between 5-20 percent.

The Allen Ridge Formation contains one to five individual coal beds. Thickness of individual coal beds ranges between 1-4 feet. These coals, unlike those in the Almond and the Pine Ridge, are more localized or less laterally continuous. Allen Ridge sandstones within the coal, carbonaceous shale, and sandstone interval vary between 2-14 feet. Porosity within the Allen Ridge sandstones ranges between 6-20 percent. Overburden mapping on top of the Almond Formation (Top of the Mesaverde Group) shows thickness varies between 1000 feet in the southeastern portion of the JRPA to 6000 feet in the northwestern portion of the area.

The main producing coals in the Pine Ridge Formation occur 250 ft.-300 ft. below the top of the Almond Formation. This would equate to burial depths between 1250 feet in the southeastern portion of the JRPA and 6250 feet in the northwestern portion of the area. Producing coals in the Allen Ridge Formation occur approximately 300 feet below the top of the Pine Ridge.

Stratigraphy of Mesaverde Formations in the Jolly Roger Project Area

The regional stratigraphy as applied to the proposed JRPA is established through correlation of wireline logs from the Pedco AR Fee 1890-5I well (SE Sec. 5 T18N R90W) with the cross sections of Roehler and Hansen (1989). The top of the Almond Formation represents the top of the Mesaverde Group. The depths of important Mesaverde Group stratigraphic markers as they occur in wells are shown in **Table 3-2**.

Table 3-2
Measured Depth of Important Stratigraphic Markers in the Pedco AR Fee 1890-5I Well

Stratigraphic Unit	Measured Depth
Almond Fm.	2368
Pine Ridge Fm.	2628
Allen Ridge Fm.	2904
Haystack Mtns. Fm.	4126
Hatfield Sandstone	4524
Deep Creek Sandstone	4754

Source: Dewey 2004.

3.2.3 Mineral Resources

The Great Divide Basin has been utilized for oil and gas drilling and production since the 1950's. Coal, natural gas, and oil are the three primary mineral resources found in the basin. Early production was mainly from upper Cretaceous reservoirs, primarily the Lewis Shale, Mesaverde, and Almond formations. Mineral development in the JRPA has been limited to natural gas and oil. At present, five coalbed natural gas exploratory unit agreements have been authorized for the Atlantic Rim.

3.2.4 Geologic Hazards

No major landslides or other geologic hazards have been mapped within the JRPA. In addition, seismic activity is low in the area.

3.2.5 Paleontology

Paleontologic resources include the remains or traces of any prehistoric organisms preserved by natural processes in the earth's crust (BLM Information Bulletin WY-93-371). The distribution and composition of fossil collections provide important information on the ecological and environmental conditions in Wyoming that existed during the Late Cretaceous Period. However, no specific data currently exists on deposits of high or undetermined paleontological potential within the JRPA.

3.3 CLIMATE AND AIR QUALITY

3.3.1 Climate

The JRPA is located in an arid to semiarid climate. Weather conditions usually consist of dry, windy conditions with limited precipitation. Meteorological data for the JRPA was collected at Rawlins, WY. However, it should be noted that meteorological data in the Great Divide Basin is limited.

The average annual precipitation at Rawlins is 10 inches, with rainfall and snowfall contributing equally to the total. On average, 51.9 inches of snow falls during the year, with March and January being the snowiest months.

Higher elevations in the region experience colder temperatures and greater precipitation. The average daily temperature during the winter ranges between a low of 5 F and a high of 33 F in January and a low of 48 F and a high of 86 F in July. The number of frost-free days varies with elevation, but normally occurs between mid-May and mid-September in the JRPA. The region has experienced several years of drought conditions.

The JRPA experiences strong winds caused by channeling and mountain valley flows in the varied topography. Winters are characterized by strong wind and snow, often creating blizzard conditions.

3.3.2 Air Quality

The National Ambient Air Quality Standards (NAAQS) and Wyoming Ambient Air Quality Standards (WAAQS) set the upper limits for concentrations of specific criteria air pollutants. These pollutants include CO, nitrogen dioxide (NO_2), ozone (O_3), particulates (PM_{10}) ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb).

Under the prevention of significant deterioration program (PSD), the permitting agency must determine if a new or modified emission source will have an adverse impact on air quality values, including visibility. The JRPA has been designated a PSD Class II area, which allows a certain level of emissions as stipulated by the permitting agency (BLM 2004).

Emission sources in the JRPA are limited, consisting of only a few industrial facilities and scattered residences. Additionally, the atmospheric conditions in the JRPA result in good dispersion of pollutants. Background values of criteria air pollutants in the region are well below the NAAQS, WAAQS, and the Colorado Ambient Air Quality Standards (CAAQS).

Background data for criteria pollutants in the region was provide by the WDEQ AQD, and the Colorado Department of Public Health and Environment, Air Pollution Control Division (CDPHE APCD 1996). **Table 3-3** shows the regional background concentrations of criteria air pollutants, WAAQS, CAAQS, NAAQS, and Class I and II increments against legal baseline provided by the WDEQ and CDPHE. Background pollutant concentrations provide data to compare predicted impacts with applicable air quality standards.

The comparisons made to PSD Class 1 and II increments are intended to evaluate an "impact threshold" and do not represent a regulatory PSD increment consumption analysis. The determination of PSD increment consumption is the responsibility of the WDEQ with oversight from the Environmental Protection Agency (EPA).

Air Quality Related Values

In addition to ambient air quality standards and PSD increments, Air Quality Related Values (AQRV's), which include the potential air pollution effects on visibility and the acidification of surface water bodies, is a concern for sensitive Class 1 and Class II areas.

Visibility is often defined in terms of atmospheric light extinction or visual range, which is the furthest distance a person can see a landscape feature. Impairment of visibility is expressed in terms of deciview (dv). The deciview index was developed as a linear perceived visual change. A change in visibility of 1.0 dv represents a "just noticeable change" by the average person under most circumstances. Larger deciview values translate into greater visibility impairment. The Forest Service (FS) has identified specific "Level of Acceptable Change" (LAC) values which they use to evaluate potential air quality impacts within wilderness areas. Continuous visibility related background data collected as part of the Interagency Monitoring of PROtected Visual Environments (IMPROVE) program are available for two sensitive receptors within the study area: Bridger and Mt. Zirkel Wilderness. The Bridger data represents existing conditions at the Bridger, Fitzpatrick, and Popo Agie wilderness areas and the Wind River Roadless Area, while the Mt Zirkel data best represents existing conditions for Dinosaur National Monument and the Mt. Zirkel, Savage Run, and Rawah wilderness areas (BLM 2004).

Both the Bridger and Mt. Zirkle visibility conditions are similar. **Table 3-4** summarizes the seasonal visibility conditions at Bridger Wilderness. As indicated, seasonal visibility in the region is very good.

Table 3-3
Background Concentrations and Ambient Air Quality Standards

Pollutant and Averaging Time	Background Concentration	Wyoming Ambient Air Quality Standards	Colorado Ambient Air Quality Standards	National Ambient Air Quality Standards	PSD Class 1 Increment	PSD Class II Increment
Carbon Monoxide (CO)						
CO 1-hr	2,299	40,000	40,000	40,000	None	None
CO 8-hr	1,148	10,000	10,000	10,000	None	None
Nitrogen Dioxide (NO_2)						
NO_2 Annual	10[B]	100	100	100	2.5	25
Ozone (0_3)						
O_3 1-hr	144[d]	None	None	235	None	None
O_3 8-hr	139 [d]	157	157	157	None	None
Particulate Matter less than 10 microns (PM_{10})						
PM_{10} 24-hr	20[c]	150	150	150	8	30
PM_{10} Annual	12[c]	50	50	50	4	17
Particulate Matter less than 2.5 microns ($PM_{2.5}$)						
$PM_{2.5}$ 24-hr	10[e]	None	None	65	None	None
$PM_{2.5}$ Annual	6[e]	None	None	15	None	None
Sulfur Dioxide (SO_2)						
SO_2 3-hr	29[f]	1,300	700	1,300	25	512
SO_2 24-hr	18[f]	260	365	365	5	91
SO_2 Annual	5[f]	60	80	80	2	20

Note: Effective February 27, 2001 the U.S. Supreme Court upheld the EPA's position on the proposed national 8-hr ozone and $PM_{2.5}$ standards. Implementation of these standards is pending.

The ozone 1-hr background concentration represents the 90th percentile of the annual maximum daily 1-hr concentrations for the months April through August.

The 8-hour ozone background concentration represents the average annual 4th highest daily maximum 8-hour average.

Other short-term background concentrations represent the second highest measured value.

Sources:

a. CDPHE, 1996 – Data collected at Rifle and Mack, Colorado in conjunction with proposed oil shale development during early 1990s.
b. BLM 1996b – To supplement monitored NO_2 data, a separate NO_2 modeling analysis was performed which included many NO_x emission sources.
c. WDEQ, 1997 data collected for the Carbon County UCG Project, data collected 9 miles west of Rawlins, WY, June 1994-November, 1994
d. Clean Air Status and Trends Network, n.d. – Data collected at Pinedale, WY (1997-1999).
e. Background $PM_{2.5}$ concentrations estimated at one-half of PM_{10} values based on EPA literature.
f. CDPHE-APCD, 1996 – Data collected at the Craig Power Plant site and Colorado Oil Shale areas from 1980-1984.

Table 3-4
Baseline Standard Visual Range for the Bridger Wilderness Area

Season	Standard Visual Range (kilometers)	Deciview (Unitless)
Annual	175	8.1
Spring	165	8.6
Summer	162	8.8
Autumn	169	8.4
Winter	218	5.9

Acidification of surface waters bodies is a concern for high altitude lakes located within FS wilderness areas. Atmospheric acid deposition is monitored as part of the National Acid Deposition Program/National Trends Network near Pinedale, Wyoming. Although the monitored deposition values are well below those levels needed to damage vegetation, lower levels of deposition may exceed the acid neutralizing capacity (ANC) of sensitive high mountain lakes.

To determine potential acid deposition impacts, the FS utilizes an LAC of no greater than 1 microequivalent/liter (eq/l) change in ANC for sensitive water bodies with existing ANC levels less than 25 eq/l. A ten percent change in ANC is considered significant for lakes with existing ANC levels over 25 eq/l. **Table 3-5** shows baseline ANC levels for sensitve mountain lakes in the region.

Table 3-5
Background ANC for Monitored Wilderness Lakes

Wilderness Area	Water Body	Background ANC (ueq/l)
Bridger	Black Joe Lake	69.0[a]
	Deep Lake	61.0[a]
	Hobbs Lake	68.0[a]
	Upper Frozen Lake	5.7[a]
Fitzpatrick	Ross Lake	61.4[a]
Popo Agie	Lower Saddlebag Lake	55.5[a]
Mount Zirkle	Pothole A-8	16.0[a]
	Seven Lakes	35.5[d]
	Upper Slide Lake	24.7[d]
Medicine Bow	West Glacier	26.1[c]
Rawah	Island Lake	64.6[a]
	Rawah #4 Lake	41.2[a]

Note: The basis for ANC data is the 10th percentile of measurements at the lake outlet when greater than years of data exist. When 5 or less years of data are available, average values are used.

Sources:

a. D. Haddow, USDA-FS, 2001.
b. T. Svalberg, USDA-FS, 2000.
c. R. Musselman, USDA-FS, 2001.
d. A. Mast, USGS, 2001.

3.4 SOILS

Texas Resource Consultants (1981) and Wells *et al*. (1981) prepared an Order III soil survey for the RFO, in cooperation with the Natural Resource Conservation Service (then Soil Conservation Service). An Order III soil survey will typically include a map scaled at 1:20,000 to 1:63,360, containing soil map units approximately 4 to 40 acres in size that delineate soil associations and complexes. This soil survey provides the best available soils data for the JRPA.

The southern portion of the JRPA (T18N R90W Sections 17, 18, 7, 8, and 9) and the northern portion of the JRPA (T19N R90W western portion of Section 33 and the eastern portion of section 32) are dominated by the Diamondville-Blazon-Forelle Association. In general, this soil unit is composed of well drained medium textured soils with moderate permeability, precipitation averages 10 to 14 inches, and the average frost-free season is about 90 days. The hazard of water erosion ranges from low to severe. Characteristics of the Diamondville-Blazon-Forelle Association are presented in **Table 3-6**.

Table 3-6
Diamondville-Blazon-Forelle Association

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard
241	Diamondville-Blazon-Forelle Association	Diamondville - 40%	Sideslopes	3 to 15 %	Soft, calcareous sedimentary rock.	Medium	Well drained	Moderate	Moderate	Low to moderate
		Blazon - 20%	Ridges	3 to 15%	Shale, siltstone, and sandstone	Medium to rapid	Well drained	Moderate	Low	Moderate to severe
		Forelle - 20%	Valley	3 to 10%	Sedimentary rock	Medium	Well drained	Moderate	High	Low to moderate

Blazon-Shinbara Complex (6 to 40 percent slopes) is located throughout the JRPA in T18N R90W Sections 4, 6, 8, 9, and 17 and T19N R90W Section 33. In general, this soil unit is composed of well drained shallow soils with moderate permeability, precipitation averages 10 to 14 inches, and the average frost-free season is about 90 days. The hazard of water is moderate to severe. Characteristics of the Blazon-Shinbara Complex are presented in **Table 3-7**.

Table 3-7
Blazon-Shinbara Complex

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard
235	Blazon-Shinbara Complex	Blazon - 45%	Ridges and sideslopes	6 to 20%	Shale, siltstone, and sandstone	Medium to rapid	Well drained	Moderate	Low	Moderate to severe
		Shinbara - 30%	Ridges and sideslopes	6 to 40%	Shale, siltstone, and loamstone	Medium to rapid	Well drained	Moderate	Low	Moderate to severe

The Cushool-Worfman-Blackhall complex is present in the southern portion of the JRPA (T18N R90 W, the eastern portion of sections 7). The soils of this complex are highly intermingled on the ridges and upper sidehill slopes. The hazard of water and wind erosion ranges from moderate to severe. Characteristics of the Cushool-Worfman Blackhall Complex are presented in **Table 3-8**.

Table 3-8
Cushool-Worfman-Blackhall Complex

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard	Wind Erosion Hazard
236	Cushool-Worfman-Blackhill Complex	Cushool - 35%	Sidehill slopes	6 to 15 %	Residium from sandstone or sandy shale	Medium to rapid	Well drained	Moderate	Low	Moderate to severe	Moderate to severe
		Worfman - 20%	Ridges and upper sidehill slopes	6 to 20%	Soft sandstone	rapid	Well drained	Moderate	-	Severe	Moderate to severe
		Blackhall - 20%	Ridges and upper sidehill slopes	10 to 30%	sandstone	rapid	Shallow and well drained	Moderate	-	Severe	Moderate to severe

The northern most portion of the JRPA (T19N R90 W section 32 and northern most portion of section 5) is dominated by the Seaverson-Blazon Complex. The Seaverson and Blazon soils are intermingled in the landscapes and the areas where each of these soils occur depends primarily on the underlying bedrock. The Seaverson soils form in very strongly alkaline shales or sandy shales, and the Blazon soils form in materials over loamstone. Characteristics of the Seaverson-Blazon complex are presented in **Table 3-9**.

Table 3-9
Seaverson-Blazon Complex

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard	Wind Erosion Hazard
237	Seaverson-Blazon Complex	Seaverson clay loam- 40%	Rolling upland ridges	3 to 10%	Shale	Slow to medium	Well drained	Moderately slow	Low	Moderate	Slight to moderate
		Blazon Loam- 30%	Rolling upland ridges	6 to 15%	Shale, Siltstone, and Sandstone	Slow to Medium	Well drained	Moderate	Low	Moderate	Slight to moderate

The northwestern portion of the JRPA (T19N R90W Section 31) has one dominant soil type, the Cusholl-Rock River Association. Characteristics of the Cushool-Rock River Association are presented in **Table 3-10**.

Table 3-10
Cushool-Rock River Association

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard	Wind Erosion Hazard
225	Cushool-Rock River Association	Cushool Sandy Loam-50%	Smoothly rolling uphill surfaces	3 to 10%		Slow to medium	Well drained	Moderate	Moderate	Moderate	Moderate to severe on unprotected soils
		Rock River Sandy Loam-30%	Valley slope positions leading into narrow drainages	6 to 20%	Calcareous residual sandy shales and sandstones	Slow to medium	Well drained	Moderate	Moderate	Moderate	Moderate to severe on unprotected soils

The northern portion of the JRPA (T18N R90W southern portion of Sections 5 and the west portion of section 4) contains the Forelle-Patent Association. Characteristics of the Forelle-Patent association are presented in **Table 3-11**.

Table 3-11
Forelle-Patent Association

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard	Wind Erosion Hazard
233	Forelle-Patent Association	Forelle Loam-40%	Valley	3 to 6%	Sedimentary rock	Slow to Medium	Well drained	Moderate	High	Slight to moderate	Slight
		Patent Loam-30%	Gentle to moderate slopes	3 to 10%	Local alluvium or slope wash	Slow to medium	Well drained	Moderate	High	Slight to moderate	Slight

The Grieves-Blackhall Association is located in the southeastern portion of the JRPA (T18N R90W Section 9). In general, this soil unit is composed of well drained soils with moderate permeability and moderate water erosion hazard. Characteristics of the Grieves-Blackhall Association are presented in **Table 3-12**.

Table 3-12
Grieves-Blackhall Association

Map Unit #	Map Unit Name	Series (% of map unit)	Landscape Position	Slope	Soil Parent Material	Runoff	Drainage Class	Permeability	Available Water Capacity	Water Erosion Hazard
251	Grieves-Blackhall Association	Grieves Sandy Loam-55%	Alluvial fans and gently sloping uplands	Moderately steep upperslopes and ridge crests at elevations of 6500 to 7800 feet	Alluvium	Medium	Well drained	Moderate	Moderate	Moderate
		Blackhall Sandy Loam-30%	Sloping to moderately steep upper slopes and ridge crests	Moderately steep upperslopes and ridge crests at elevations of 6500 to 7800 feet	Soft sandstone residuum	Medium to rapid	Well drained	Moderate	Very low	Moderate

3.4.1 Biological Soil Crusts

Biological soil crusts are a component of Wyoming's semiarid rangelands, especially in the Wyoming big sagebrush cover type. Biological soil crusts are predominantly composed of cyanobacteria (formerly blue-green algae), green and brown algae, mosses, and lichens. Liverworts, fungi, and bacteria can also be important components. Because they are concentrated in the top 1-4 mm of soil, they primarily affect processes that occur at the soil surface or soil-air interface, including soil stability, decreased erosion potential, atmospheric nitrogen fixation, nutrient contributions to plants, soil-plant-water relations, infiltration, seeding germination, and plant growth. Crusts are well adapted to severe growing conditions, but poorly adapted to compressional disturbances such as trampling by humans, livestock, wild horses, wildlife, or vehicles. Disruption of the crusts decreases organism diversity, soil nutrients, stability, and organic matter (Belnap *et al*. 2001). The presence of biological soil crusts on or near the JRPA has not been verified, but they may potentially occur.

3.5 WATER RESOURCES

3.5.1 Groundwater

Groundwater resources include deep and shallow confined and unconfined aquifers. Site specific data on groundwater for the JRPA are limited. The producing coal seams in the Mesaverde Group are classified as confined to semi-confined because they are bounded by confining layers that consist of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the coal seams and any aquifer stratigraphically above or below the coal seams is limited. Deep injection wells are proposed for the Cherokee and Deep Creek Sandstones, which occur between 3,800 feet to 4,600 feet below the surface. The rocks that compose the Mesaverde group are conglomerates, consisting of sandstone, siltstone, mudstone, claystone, carbonaceous shale, limestone, and coal. Because these rocks were deposited as sea level changed during the Late Cretaceous Period, lithology varies vertically and laterally, and intertounging is common among the various formations and strata that make up these aquifers. Recharge is mainly from infiltration of snowmelt and rainfall.

3.5.1.1 Quality

Groundwater quality is related to aquifer depth, flow between aquifers, and the rock type. Groundwater quality is variable in the JRPA. TDS, an indicator of salinity, is generally less than 2,000 milligrams per liter (mg/L) (slightly saline to saline) in the JRPA producing formations, with local concentration of less than 500 mg/L (considered fresh and meeting EPA National Secondary Drinking Water Regulations).

The proposed JRPA wells occur in the Mesaverde Group aquifers. **Table 3-13** lists the major cation and anion composition of groundwater from the Mesaverde Group in the JRPA. Sodium and bicarbonate dominate as the major ionic species. Collentine *et al*. (1981) offer three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction, resulting in generation of bicarbonate; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde or adjacent aquifers.

Table 3-13
Major Ion Composition of Mesaverde Groundwater

Cation	Concentration (mg/L)	Anion	Concentration (mg/L)
Sodium	513	Bicarbonate[a]	1,284
Calcium	7	Carbonate[b]	9
Magnesium	3	Chloride	56
Potassium[b]	5	Sulfate	11

Notes:

a. Bicarbonate was not measured; value shown was calculate from ion balance.

b. Concentrations of potassium and carbonate were not measure in well samples; values represent composite of USGS data for Mesaverde wells in the vicinity of the project (USGS 1980) mg/L= milligrams per liter.

Table 3-14 presents a comparison of groundwater quality from the Mesaverde Group, including WDEQ standards for groundwater suitability. The results from three gas wells analyzed indicate water that is generally suitable for livestock use, but is unsuitable for domestic supply or irrigation without treatment or dilution. Parameters measured at concentrations that exceed drinking water standards include iron, manganese, and TDS. Calculated values for sodium adsorption ration (SAR) (47.3) and residual sodium carbonate (41 milliequivalents per liter (meq/L) exceed the agriculture suitability limits of 8 for SAR and 1.25 for residual sodium carbonate. Unless the water supply were mixed with an existing water source of lower sodium, bicarbonate, and lower total salinity, irrigation with this water would reduce infiltration in the affected soil and potentially decrease crop production.

Table 3-14
Groundwater Quality for Mesaverde Wells in the JRPA

Parameter	Concentration[a]	Unit	Groundwater Suitability Standards[b]		
			Domestic	Agriculture	Livestock
Aluminum	0.045	mg/L	---	5	5
Ammonia	0.9	mg/L	0.5	---	---
Arsenic	0.0006	mg/L	0.05	0.1	0.2
Barium	0.36	mg/L	1	---	---
Beryllium	<0.002	mg/L	---	0.1	---
Boron	0.25	mg/L	0.75	0.75	5
Cadmium	<0.0002	mg/L	0.01	0.01	0.05
Chloride	56	mg/L	250	100	2,000
Chromium	0.002	mg/L	0.05	0.1	0.05
Cobalt	NM	mg/L	---	0.05	1
Copper	0.03	mg/L	1	0.2	0.5
Cyanide	<5	mg/L	0.2	---	---
Fluoride	1.0	mg/L	1.4 - 2.4	---	---
Hydrogen Sulfide	NM	mg/L	0.05	---	---
Iron	3.06	mg/L	0.3	5	---
Lead	0.004	mg/L	0.05	5	0.1
Lithium	NM	mg/L	---	2.5	---
Manganese	0.102	mg/L	0.05	0.2	---
Mercury	<0.0004	mg/L	0.002	---	0.00005
Nickel	0.041	mg/L	---	0.2	---
Nitrate	<0.03	mg/L	10	---	---
Nitrite	<0.03	mg/L	1	---	10
Oil & Grease[c]	<1	mg/L	Virtually Free	10	10
Phenol	65	mg/L	0.001	---	---
Selenium	<0.005	mg/L	0.01	0.02	0.05
Silver	<0.003	mg/L	0.05	---	---
Sulfate	11	mg/L	250	200	3000
TDS	1,322	mg/L	500	2000	5000
Uranium	NM	mg/L	5	5	5
Vanadium	NM	mg/L	---	0.1	0.1
Zinc	0.3	mg/L	5	2	25
pH	8.2	s.u.	6.5 - 9.0	4.5 - 9.0	6.5 - 8.5
SAR	47.3	<none>	---	8	---
RSC[d]	41	meq/L	---	1.25	--
Radium 226 + Radium 228	0.9	pCi/L	5	5	5
Strontium 90	NM	pCi/L	8	8	8
Gross alpha	NM	pCi/L	15	15	15

a. Concentrations of boron, ammonia, fluoride, and nitrate/nitrite in samples from 11 Mesaverde groundwater wells (USGS 1980); remaining concentrations from three Mesaverde gas wells in JRPA.
b. From WDEQ Water Quality Rules and Regulations, Chapter VIII.
c. Reported as total petroleum hydrocarbons.
d. Residual sodium carbonate calculated from measured calcium and magnesium concentrations and calculated concentration of bicarbonate.

Notes:
meq/L = Milliequivalents per liter
mg/L = Milligrams per liter
NM = not measured
pCi/L = Picocuries per liter
s.u. = Standard units
TDS = Total dissolved solids

3.5.2 Surface Water

The JRPA is located within the Great Divide Basin Watershed (United States Geological Service [USGS] Hydrologic Unit Code 14040200). The Great Divide Basin is a closed basin. Many of the drainages within or near the JRPA are ephemeral (i.e. carry water only in direct response to snow melt and precipitation events). Surface waters near the JRPA include the intermittent to perennial Separation Creek, intermittent Fillmore Creek, and several other intermittent or ephemeral drainages that flow into Separation or Fillmore Creek.

3.5.2.1 Quantity

Statistics on flow have been compiled for the USGS gaging station (#09216527), which is located on Separation Creek. There are no stream gaging stations in the JRPA. This information is summarized in **Table 3-15**.

Table 3-15
Historical Streamflow at Selected USGS Gaging Stations

Station Name	Station Number	Drainage Area (mi^2)	Period Of Record	Mean Annual Flow (cfs)	Mean Annual Flow (ac-ft/year)	Maximum Peak Flow (cfs)	Annual Runoff (ac-ft/yr)
Separation Creek near Riner, WY	09216527	53.3	10/1/75-9/30/81	2.1	1,520	141	1,300

Source: USGS 2003
mi^2 = square mile
cfs= cubit feet per second
ac-ft/yr= acre-feet per year

Peak flow typically occurs during April and May in response to snow melt, and many drainages and streams will be dry by early June. Following peak flow events, these streams and drainages only flow in direct response to rainfall events. Lowham (1976) estimated long-term flow characteristics at Station #09216527. These estimates were based on channel and basin characteristics and are summarized in **Table 3-16**.

Table 3-16
Long-Term Flow Estimates at Separation Creek

Station Name And Number	2-Year Peak Flow	5-Year Peak Flow	10-Year Peak Flow	25-Year Peak-Flow	50-Year Peak Flow	Average Annual Runoff
Separation Creek near Riner, WY 09216527	39 cfs	100 cfs	170 cfs	290 cfs	420 cfs	1,500 ac-ft/yr (2.07 cfs)

Source: Lowham 1976
cfs= cubit feet per second
ac-ft/yr= acre-feet per year

3.5.2.2 Reservoirs

There are three existing reservoirs in the JRPA. Fillmore Reservoir #1 is located in Section 6 in T18N R90W, this reservoir is 100 acre-feet in capacity and was permitted for stock water and waterfowl habitat. Fillmore Reservoir #1 is in poor structural condition and has lost the capacity to hold 100 acre-feet of water due to the accumulation of silt. Fillmore Reservoir #2 is located in Section 8 in T18N R90W. This reservoir is 4 acre-feet in capacity and was permitted for stock water. Fillmore Reservoir #2 is also in poor condition and has lost some water storage capacity due to the accumulation of silt. The third reservoir is located on a non-federal parcel of land (Newberry 2004a).

3.5.2.3 Quality

Data on water quality collected at the USGS monitoring station on Separation Creek are shown in **Table 3-17**. In general, because many of these streams only flow in response to precipitation events, sediment loads can be high. In addition, many areas with saline soils generally have higher TDS values. Very little water quality data is available for the JRPA, however some data is available for Separation Creek (which is a characteristic stream found in the Great Divide Basin watershed).

Table 3-17
Surface Water Quality – Separation Creek Near Riner, WY

Station Name	Separation Creek Near Riner, WY
Station Number	09216527
Period of Records	1975-1981
Number of Samples[b]	39
pH, standard units	8.20
Total Dissolved Solids (TDS)[c]	774
Total Suspended Solids	363
Turbidity (JTUs)[d]	131
Hardness as $CaCO_3$	467
Dissolved Oxygen	9.01
Sodium	80.4
Calcium	74.4
Magnesium	68.6
Potassium	5.5
Bicarbonate	276
Sulfate	385
Chloride	13
Nitrate	0.14
Sodium Adsorption Ration (SAR), unitless	1.6

Source: USGS 2004

a. Values all representative of means
b. Total number of grab samples analyzed; not every parameter was analyzed in every sample.
c. All units are milligrams per liter (mg/L) except as noted
d. Jackson Turbidity Units.

3.5.2.4 Waters of the United States

The Great Divide Basin has no external outlet and surface waters have no known connection to external drainages or to navigable waterways leaving the state. As a result, surface water features in the JRPA are not part of a tributary system to interstate waters or navigable waters and do not qualify as Waters of the United States.

3.5.2.5 Water Use

Surface water use in the Great Divide Basin is dominated by irrigation, although this use is limited. Estimates of water use for the Great Divide Basin by the USGS indicate that in 1995 total surface water withdrawals equaled 103.2 million gallons per day (MGD). Irrigation represented 99 percent of surface water withdrawals (estimates of surface water withdrawals for irrigation totaled 102.7 MGD) (USGS 1995).

3.5.2.6 Water Rights

Surface water rights do exist on the JRPA and are on file with the Wyoming State Engineer Office (WSEO).

3.6 VEGETATION, WETLANDS, AND INVASIVE WEEDS

3.6.1 Vegetation and Cover Types

Vegetation in the JRPA is primarily dominated by Wyoming big sagebrush (*Artemisia tridentada ssp wyomingensis*). The JRPA is located within the High Plains SE (10" -14") precipitation zone, Region 9 (USDA-NCRS 1986).

Vegetation cover types for the JRPA were obtained from the Wyoming Geographic Information Science Center and used to delineate primary and secondary vegetation cover type boundaries. Information for plant species of concern was obtained from the Wyoming Natural Diversity Database (WYNDD) (WYNDD 2003). Based upon the Wyoming Gap Analysis Program (GAP, Merrill *et al*. 1996), Wyoming big sagebrush is the primary cover type on the entire JRPA (100 %). Secondary cover types are greasewood fans and flats (1.6 %), basin exposed rock/soil (56.7 %), with the remaining 41.7 % of the area unclassified (**Table 3-18**).

Table 3-18
Vegetation Cover Types within the JRPA as Identified by the Wyoming Gap Analysis (Merrill et al. 1996).

Vegetation Cover Type	Primary		Secondary	
	Acres	Percent	Acres	Percent
Wyoming big sagebrush	3,910.5	100.0	------	------
Basin exposed rock/soil	------	------	2,214.8	56.7
Greasewood fans and flats	------	------	63.7	1.6
Unclassified	------	------	1,632	41.7
TOTAL	3,910.5	100.0	3,910.5	100.0

The Wyoming big sagebrush cover type description from the Wyoming GAP analysis (Merrill *et al*. 1996) is as follows: "Total shrub cover in this type comprises more than 25% of the total vegetative cover. This type is variable in Wyoming and ranges from dense, homogeneous Wyoming big sagebrush to sparsely vegetated arid areas where Wyoming big sagebrush is the dominant shrub. Often, patches of Wyoming big sagebrush are found with patches of mixed grasses. In these cases the type is classified as Wyoming big sagebrush steppe if the sagebrush patches occupy more than 50 percent of the total landscape area and as mixed grass if the grasses occupy more than 50 percent of the total area". Resolution of the GAP data is approximately 100 hectares (248 acres), therefore, smaller stands of some secondary cover-types such as basin big sagebrush (*Artemisia tridentata ssp. tridentata*) and cushion plant communities, although present, may fail to appear on the map and their extent cannot be calculated.

On-site measurements performed on May 20, 2004 indicated that sagebrush canopy cover values on the JRPA ranged from approximately 10-15 percent to >40 percent. The 10-15 percent value is common for the general area and increases to about 40 percent in proximity to ephemeral drainage sites where soils are deeper. Based on several measurements, Wyoming big sagebrush

plant density (stems/unit area) was estimated to be approximately 10,000 plants/acre; average height (H) ranged from 30-40 cm.

Major draws in the JRPA usually have linear stands of basin big sagebrush that parallel the draw. Average sagebrush height along several of these draws ranged from 150-163 cm. Greasewood (*Sarcobatus vermiculatus*) is commonly intermixed with sagebrush along Fillmore Creek. Both the native rabbitbrush species (*Chrysothamnus nauseosus* and *C. viscidiflorus*) are present in the JRPA. Several small saltbush (*Atriplex gardneri*) dominated communities also occur on the JRPA and these sites are characterized by an accumulation of salt in poorly developed soils with a pH of 7.8 to 9.

Dominant grasses are mostly in the wheatgrass family; Basin wildrye (*Leymus cinereus*) is common along Fillmore Creek. Grasses occupy all shrub interspaces with a minimum of bare ground. Annual production (shrubs and grasses) is probably high for this area. Common forb species include the phloxs, buckwheats, penstemons, dandelion (*Taxafolium offinale*), Plains prickly-pear cactus (*Opuntia* sp.), scurfpea (*Psoralea tenuiflora*), Indian paintbrush (*Castilleja* sp.), and arrowleaf balsamroot (*Balsamorhiza sagittata*).

3.6.2 Federal Threatened and Endangered Plant Species

Three federally listed plant species, the blowout penstemon (*Penstemon haydenii*), Ute-ladies'-tresses (*Spiranthes diluvialis)*, and Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*) are listed as potentially occurring on lands administered by the RFO (USDI-FWS 2003). However, only the blowout penstemon and Ute-ladies'-tresses could potentially occur in the Carbon County portion of lands administered by the RFO.

Blowout penstemon

Blowout penstemon is a member of the Scrophulariaceae (Figwort) family (Fertig 2001) and is one of the rarest plant species native to the Great Plains (Nebraska Game and Parks Commission [NGPC] 2002). The species is found in the open, sandy habitats of wind-excavated depressions (blowouts) in dune tops. In Wyoming, the species has also been documented on very steep, unstable sand dunes. Within these limited habitats, this short-lived perennial herb frequently occurs in large, multi-stemmed clumps. In June and July, when it is in bloom in Wyoming, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts.

Blowout penstemon, a FWS endangered species, is known to occur in certain habitats south of the Ferris Mountains in the northern part of Carbon County. Suitable habitat for blowout penstemon is not present in the JRPA, but the plant has the potential to occur approximately ten miles south of the JRPA (Fertig 2001), in the Sand Hills area where a few active sand dunes are known to exist. However, the species was not found during field surveys of the Sand Hills area by WYNDD personnel in June 2000 (Fertig 2001). The closest known populations of blowout penstemon are located south of the Ferris Mountains (Blomquist 2003). Given the absence of suitable habitat (sand dunes with active blowouts) in the JRPA, blowout penstemon does not occur within the JRPA.

Ute ladies'-tresses

The Ute ladies'-tresses (Spiranthes diluvialis), a federally threatened species, is a perennial, terrestrial orchid, endemic to moist soils near wetland meadows, springs, lakes, and perennial streams. It occurs generally in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows at elevations from 4,200 to 7,000 feet. The orchid colonizes early successional riparian habitats such as point bars, sand bars, and low lying gravelly, sandy, or cobbly edges, persisting in those areas where the hydrology provides continual dampness in the root zone through the growing season. This species has been located in Converse, Goshen, Laramie, and Niobrara counties in Wyoming (Fertig 2000). Ute ladies'-tresses typically blooms from late July through August, however, it has been known to bloom in early July and as late as early October (USDI-FWS 2003). Suitable habitat for the Ute ladies'-tresses does not occur within the JRPA and this species is not expected to occur there.

3.6.3 Species of Concern

Seven plant species of special concern may potentially occur on or near the JRPA (USDI-BLM 2002, WYNDD 2003). Plants of special concern that may occur in the RFO management area and information on their names, sensitivity status, probability of occurrence in the JRPA, and descriptions of habitat types in which these special concern plants are found are listed in **Table 3-19**. Of these, Gibben's beardstongue has the highest conservation priority (WYNDD 2003) and particular attention should be given to avoid impact to this species. None of the species listed have known occurrences within the JRPA (WYNDD 2003). The seven sensitive plant species have moderate potential to occur on or near the JRPA.

Table 3-19
Sensitive Plant Species with Potential to Occur on or near the JRPA

Common Name	Scientific Name	Status1	Habitat	OP
Smallflower androstephium	*Androstephium breviflorum*	G5/S1	Open, south-facing slopes; erosional slopes; deep sandy-silty-loamy soils	M
Hayden's milkvetch	*Astragalus bisculatus var. haydenianus*	G5T4?/S1	Moist clay soils; spring draws; associate with dense graminoids and shrubs 6600 to 7660'	M
Nelson's milkvetch	*Astragalus nelsonianus*	G2/S2	Alkaline clay flats, shale bluffs, pebbly slopes and volcanic cinders in sparsely vegetated sagebrush, juniper & barren clay slopes 6500 to 8200'	M
Wolf's orache	*Atriplex wolfii*	G3/G4/S1	Alkaline or clay soils; elevated mounds near aquatic sites; associated with greasewood	M
Gibben's beardtongue	*Penstemon gibbensii*	G1/S1	Barren south-facing slopes on loose sandy-clay derived from Brown's Park formation; may occur in grass-dominated sites with scattered shrubs; semi-barren fringed sagebrush/thickspike wheatgrass communities with 15-20% vegetation cover, or ashy slopes amid *Cercocarpus montanus*; may also occur on outcrops of Green River Formation on steep yellowish sandstone-shale slopes below caprock edges.	M
Pale blue-eyed grass	*Sisyrinchium pallidum*	G2G3/S2S3	Wet meadows, stream banks, roadside ditches & irrigated meadows 7000 to 7900'	M
Laramie false sagebrush	*Sphaeromeria simplex*	G2/S2	Cushion plant communities on rocky limestone ridges & gentle slopes 7500 to 8600'	M

Sources: USDI-BLM (2002), WYNDD (2003).

1 - Definition of status

G *Global rank: Rank refers to the range-wide status of a species.*

T *Trinomial rank: Rank refers to the range-wide status of a subspecies or variety.*

S *State rank: Rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.*

1. Critically imperiled because of extreme rarity (often known from 5 or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.

2. Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.

3. Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).

4. Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.

5. Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.

2 – Project Area Occurrence

M- Moderate potential

U- Unlikely to occur

3.6.4 Wetlands

No jurisdictional wetlands exist within the JRPA and the nearest intermittent stream is Fillmore Creek. The location and classification of potential wetlands within the JRPA were determined from a FWS National Wetlands Inventory (NWI) map. Seven types of polygon wetland features (78.8 total acres) and three types of linear wetland features (12,810.7 total feet) are located within the JRPA; most are located along Fillmore Creek. The Cowardin System (Cowardin *et al*. 1979) classifies the wetland types as follows (**Table 3-20**): L2ABGh – Lacustrine, littoral, aquatic bed, intermittently exposed, diked/impounded; PABFh – Palustrine, aquatic bed, semipermanently flooded, diked/impounded; PEMA – Palustrine, emergent, temporarily flooded; PEMC Palustrine, emergent, seasonally flooded; PEMCh – Palustrine, emergent, seasonally flooded, diked/impounded; PEMFh – Palustrine, emergent, semipermanently flooded, diked/impounded; PUSCh – Palustrine, unconsolidated shore, seasonally flooded, diked/impounded; R4SBA – Riverine, intermittent, streambed, temporarily flooded.

Table 3-20
United States Fish and Wildlife Service National Wetland Inventory Classification of Wetlands Present within the JRPA[A]

Wetland Type[B]	Polygon Features			Linear Features		
	Count	Hectares	Acres	Count	Meters	Feet
L2ABGh	1	7.2	17.7	-	-	-
PABFh	3	2.4	5.9	-	-	-
PEMA	1	1.0	2.4	3	990.5	3,249.7
PEMC	5	9.0	22.1	6	2,864.2	9,397.0
PEMCh	4	8.2	20.3	-	-	-
PEMFh	1	3.8	9.4	-	-	-
PUSCh	3	0.4	1.0	-	-	-
R4SBA	-	-	-	1	50.0	164.0
Totals	21	32.0	78.8	10	3,904.7	12,810.7

A Source: FWS NWI data.
B See Cowardin et al. (1979) for classification description. Available at the NWI website: http//www.nwi.fws.gov/Pubs_Reports/public.htm

3.6.5 Noxious and Invasive Weeds

Weed invasion and establishment is minimal in the JRPA. However, this area is vulnerable to invasion of noxious and invasive weed species such as Canada Thistle (*Cirsium arvense*), spotted knapweed (*Centaurea maculosa Lam*.), Russian knapweed (*Centaurea repens L*.), whitetop (*Cardaria draba*), tamarisk or saltcedar (*Tamarix spp*.), and invasive species such as, halogeton (*Halogeton glomeratus*), curlycup gumweed (*Grindelia squarrosa*), annual goosefoot (*Chenopodium*), Russian thistle (*Salsosa iberica*), cheatgrass (*Bromus tectorum L*.), and several annual mustards. These invasive species are normally restricted to disturbed areas.

Any newly disturbed surface (e.g., well pads, pipeline, and road ROWs) within the JRPA will be susceptible to invasive/noxious weed infestations. **Table 3-21** shows the current designated noxious weed list in Wyoming.

Table 3-21
Designated Noxious Weeds in Carbon County, WY

Scientific Name	Common Name
Agropyron repens	Quackgrass
Ambrosia tomentosa	Skeletonleaf bursage
Arctium minus	Common burdock
Cardaria draba, C. pubescens	Hoary cress, whitetop
Carduus acanthoides	Plumeless thistle
Carduus nutans	Musk thistle
Centaurea diffusa	Diffuse knapweed
Centaurea maculosa	Spotted knapweed
Centaurea repens	Russian knapweed
Chrysanthemum leucanthemum	Ox-eye daisy
Cirsium arvense	Canada thistle
Convolvulus arvensis	Field bindweed
Cynoglossum officinale	Houndstongue
Euphorbia esula	Leafy spurge
Isatis tinctoria	Dyers woad
Lepidium latifolium	Perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Linaria vulgaris	Yellow toadflax
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Sonchus arvensis	Perennial sowthistle
Tamarisk spp.	Salt cedar
Hypericum perforatum	Common St. Johnswort
Tanacetum vulgara	Common tansy

1 Designated Noxious Weeds, Wyoming Stat. § 11-5-102 (a)(xi) and Prohibited Noxious Weeds, Wyoming Stat. § 11-12-104.

In addition to the 24 species listed in Table 3-21, halogeton, plains prickly pear, larkspur, and lupine are declared noxious by Carbon County (Justensen 2004).

3.7 RANGE RESOURCES

3.7.1 Range Resources

The JRPA is located entirely within the Fillmore Allotment (#10609) managed by the BLM RFO in accordance with the Great Divide RMP. The allotment includes 42,335 acres, of which 19,409 acres are on public land (approximately 44 percent) and 22,926 acres of private land (approximately 56 percent). The Fillmore Allotment supports 3,374 animal unit months (AUMs), which includes 3,300 cattle AUMs and 74 horse AUMs. The average stocking rate is 5.75 acres per AUM. A temporary increase in permitted use (up to 25 percent) was granted in 1997 and was monitored for three years. At the end of the three-year period, monitoring indicated that range and resource conditions were maintained to BLM standards. Based on this data, the permittee was granted a permanent 25 percent increase in their AUMs (Newberry 2004b).

The allotment is utilized from May through the end of September. Numerous range improvement projects have been completed for this allotment, which have enhanced range and resource conditions. These improvement projects have included: prescribed burns, fencing, instream structures, spring development, Spike 20P treatments, and small reservoir construction and/or maintenance. Prescribed burns completed in 1994,1995, and 1999 have burned approximately 31 percent of the allotment (BLM 1998). Monitoring of treated sites has shown that with managed post-treatment use, plant densities and overall health of herbaceous vegetation has increased. Continued BLM monitoring of the Fillmore Allotment has rated the condition of the range conditions as good to excellent and utilization is light by livestock (BLM 2003a).

3.8 WILDLIFE

The JRPA is located in the sagebrush steppe plant community that is typical of the high inter-mountain desert of south central Wyoming. The primary vegetation in the JRPA is Wyoming big sagebrush with interspersed mixed grasses. The JRPA includes approximately 3,910.5 acres of sagebrush steppe/mixed grass wildlife habitat. Many common species of birds, mammals, amphibians, and reptiles are found within the JRPA. The survey and analysis area for the greater sage-grouse consisted of the JRPA plus a 2-mile buffer around the JRPA and the pipeline. The survey and analysis area for raptors included the JRPA plus a 1-mile buffer around the JRPA and the pipeline. **Figure 3-1** shows the location of critical wildlife resources located within and close to the JRPA.

Information regarding the potential occurrence of federally threatened or endangered species, species of concern, big game, raptors, and greater sage-grouse near the JRPA was obtained from several sources. Greater sage-grouse lek locations, seasonal big game range designations, and locations for threatened and endangered species were obtained from the Wyoming Game and Fish Department's (WGFD) Wildlife Observation System (WOS), WGFD regional biologists, the BLM, and the WYNDD. WGFD big game herd unit annual reports were used for herd unit population statistics. Previously identified raptor nest locations were obtained from the BLM, RFO.

Existing wildlife information for the JRPA was supplemented through survey data collected by Hayden-Wing & Associates (HWA) biologists between 2001 and 2004. Wildlife surveys performed by HWA from 2001-2003 were conducted as part of larger scale surveys being performed in preparation for the Atlantic Rim EIS. Wildlife field work conducted within the JRPA during 2001 included: (1) a helicopter survey to determine the status of nesting raptors, (2) ground-truthing and mapping of white-tailed prairie dog towns, (3) the identification and mapping of potential mountain plover habitat, and (4) a helicopter survey to locate habitat areas being used by greater sage-grouse during severe winter conditions. Surveys for presence/absence of mountain plover were conducted in potential habitat areas for three consecutive years from 2001-2003. In the spring of 2004, aerial and ground surveys were conducted to locate and determine activity status of greater sage-grouse leks on and within two miles of the JRPA and to locate active raptor nests on and within one mile of the JRPA.

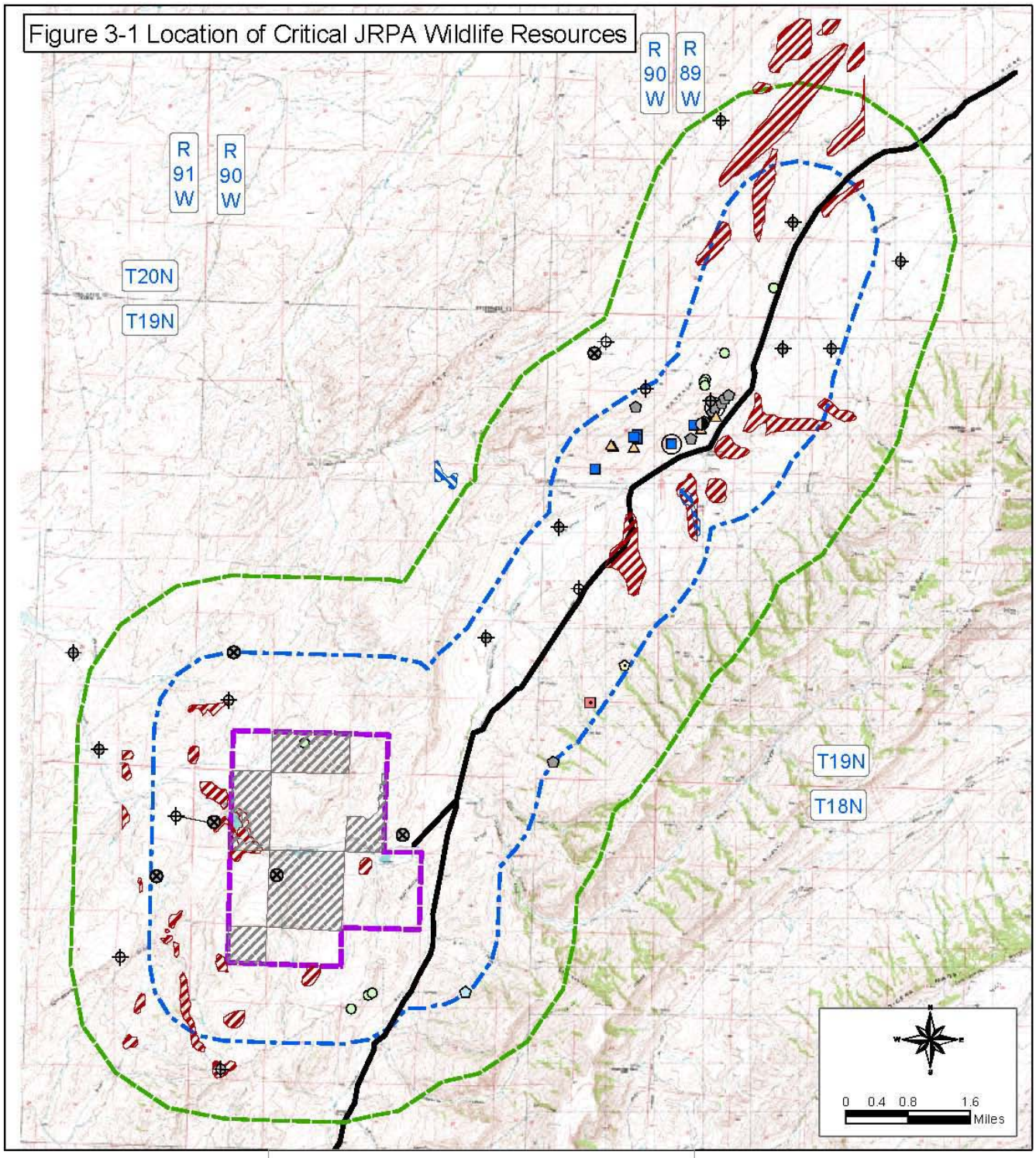
Figure 3-1 Location of Critical JRPA Wildlife Resources
R 91 W
R 90 W
R 90 W
R 89 W
T20N
T19N
T19N
T18N
0 0.4 0.8 1.6
Miles
LEGEND
Jolly Roger POD
Raptor Survey Area
2 Mile Sage Grouse Buffer
Sales Pipeline
Potential Sage Grouse Nesting Habitat on BLM Land within the POD
Raptor Nests
Coopers Hawk
Ferruginous Hawk
Golden Eagle
Northern Goshawk
Prairie Falcon
Red Tailed Hawk
Swainsons Hawk
Unknown Raptor
Active Nest 2004
White-tailed Prairie Dog Towns
Potential Mountain Plover Habitat
Active Sage Grouse Leks
Inactive Sage Grouse Leks
Unknown Sage Grouse Leks

Potential greater sage-grouse nesting habitat on the JRPA was mapped in the spring of 2004. During all surveys conducted by HWA biologists, any observations of threatened, endangered, proposed, or sensitive species were noted. Information regarding the potential occurrence of sensitive species within the JRPA was also obtained from the WYNDD.

3.8.1 Big Game

Three big game species: pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*) utilize the JRPA during the course of a year. Four seasonal ranges, designated by the WGFD, occurring within the JRPA include: crucial winter/yearlong; winter; winter/yearlong; and spring/summer/fall. Crucial big game range (e.g., crucial winter/yearlong range) includes any seasonal range or habitat component that has been documented as a determining factor in a population's ability to maintain itself at a specified level over the long-term. Winter ranges are used by substantial numbers of animals only during the winter months (December through April). Winter/yearlong ranges are occupied throughout the year, but during winter they are used by additional animals that migrate from other seasonal ranges. Spring/summer/fall ranges are used before and after winter conditions end. Areas designated as OUT (or non-use areas) contain habitats of limited importance to the species.

3.8.1.1 Pronghorn

The JRPA is located within the 1,394-square-mile Baggs Pronghorn Herd Unit and contains two types of pronghorn seasonal ranges: winter/yearlong (3,462 acres) and spring/summer/fall (448 acres). Pronghorn likely migrate through the JRPA along several routes as they move to and from spring/summer/fall ranges. The 2002 population estimate for the Baggs Herd Unit was 8,600 animals, which was 4.4 percent below the objective of 9,000 (WGFD 2003a). The JRPA is located within Hunt Area 55, where the hunter success rate for 2002 was 100 percent.

3.8.1.2 Mule Deer

The JRPA is located within the Baggs Mule Deer Herd Unit. The Baggs Herd Unit is very large (3,440 square miles) and contains habitats ranging from subalpine and montane coniferous forests to desert scrub. The JRPA is entirely within winter/yearlong range (3,910 acres) and no mule deer migration routes pass through the JRPA. The 2002 population estimate for the Baggs Herd Unit was 20,500 (WGFD 2003a). This estimate is above the WGFD management objective of 18,700. The JRPA is located within Hunt Area 84; of all the mule deer licenses issued in the Baggs Herd Unit in 2002, only 4.4 percent were issued in Hunt Area 84. The hunter success rate in hunt area 84 in 2002 was 70 percent.

3.8.1.3 Elk

The JRPA is located within the Sierra Madre Elk Herd Unit (2,425 square miles). Most elk in the herd unit utilize spring/summer/fall ranges in the Sierra Madre Mountains, although there are groups using habitats on the ARPA and around McCarty Canyon. During winter, the elk migrate to lower elevation winter range habitats on the west side of the Sierra Madre Mountains and into the ARPA/Sand Hills areas. Some animals may migrate as far west as the Powder Rim (~ 40 miles west of Baggs, WY; Porter 1999). However, no major elk migration routes pass through the JRPA. The majority of the JRPA is classified as elk winter range (3,908 acres) and the extreme southeast corner of Section 9 T18N:R90W is classified as crucial winter/yearlong range

(1.8 acres). Elk winter use of the JRPA may have increased in recent years following controlled burns that have increased the availability of herbaceous vegetation. The 2002 post-hunt season population estimate for the Sierra Madre Herd Unit of 5,300 animals is 26 percent above the WGFD management objective of 4,200 (WGFD 2003a). The JRPA is located within Hunt Area 108, where the hunter success rate for 2002 was 69.8 percent.

3.8.2 Upland Game Birds

3.8.2.1 Greater Sage-Grouse

The JRPA is located within the extensive sagebrush/grassland habitat of southcentral Wyoming where greater sage-grouse are common inhabitants. Strutting grounds (leks), nesting, brood-rearing, and wintering habitats are all important habitat components required by greater sage-grouse (*Centrocercus urophasianus*). Sometimes these habitats are contiguous and other times occur in a patchy, disconnected pattern (Call and Maser 1985). Approximately 50 percent of greater sage-grouse hens usually nest within two miles of leks (Braun *et al*. 1977, Hayden-Wing *et al*. 1986, Wakkinen *et al*. 1992, Wallestad and Pyrah 1974). The greater sage-grouse is not formally listed as a federally threatened or endangered species, but it has been petitioned to be listed under the Endangered Species Act (ESA) and the FWS is currently reviewing the status of the greater sage-grouse. The greater sage-grouse is considered a sensitive species by the BLM in Wyoming.

The JRPA is located within the Sierra Madre upland game management unit area (Area 25). According to the Annual Report of Upland Game and Furbearer Harvest for 2002, 585 greater sage-grouse were harvested in Area 25 providing 643 hunter recreation days (WGFD 2003b). The Sierra Madre Upland Game Management Area accounted for approximately 12.1 percent of the state-wide harvest of greater sage-grouse in 2002.

Surveys to determine greater sage-grouse lek activity were conducted on and within a 2-mile buffer of the JRPA (HWA 2004a). Surveys were conducted in accordance with WGFD protocols obtained from the BLM for use in the 2004 survey season. Surveys included two dawn aerial flights (March 24 and April 1, 2004) over the entire survey area and one ground survey on BLM lands within the survey area. At the request of the landowner, ground surveys were not conducted on private lands within the survey area. Greater sage-grouse locations were recorded using Global Positioning System (GPS) equipment and a USGS topographic map. The number of birds observed was also documented. While traveling between known lek locations, any new lek observations were recorded. Greater sage-grouse lek surveys were also conducted by the BLM and WGFD in the vicinity of the JRPA in the spring of 2004.

Based upon surveys conducted by HWA, WGFD, and BLM in 2004, there were ten active leks, three inactive leks, and six leks with unknown activity status on and within two miles of the JRPA. According to the WGFD, lek #17 (Fillmore Ranch Lek) has two strutting centers and birds have historically been observed strutting on each center alternately and on both centers simultaneously. In 2004, HWA observed males strutting on the west center of the lek, which is located just outside of the JRPA boundary; no grouse were observed on the east center of the lek in 2004. One inactive lek (#14) was located within the JRPA. One active lek was located approximately ¼ mile northwest of the proposed pipeline in Section 23.

The entire JRPA are located within two miles of greater sage-grouse leks and is subject to seasonal restrictions to protect nesting greater sage-grouse. Potential greater sage-grouse nesting habitat on BLM-managed land within the JRPA was mapped in April and May, 2004. Nesting habitat criteria outlined in the Wyoming Greater Sage-Grouse Conservation Plan were used as a guide to map potential nesting habitats. Approximately 43.9 percent (1,714.9 acres) of the JRPA is located on BLM-managed land, and of that area, 88.0 percent (1,509 acres) was considered to be potential greater sage-grouse nesting habitat.

Aerial surveys were conducted by HWA biologists during the winter of 2001 to identify and define ARPA greater sage-grouse concentration areas during the severe winter (HWA 2004b). Those areas of habitat where greater sage-grouse were located during the winter aerial survey were termed severe winter relief habitat. No severe winter relief greater sage-grouse habitat was located within the JRPA in 2001.

3.8.2.2 Raptors

Raptor species that may occur on or near the JRPA and pipeline include golden eagle, bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, American kestrel, merlin, prairie falcon, peregrine falcon, short-eared owl, long-eared owl, great-horned owl, and burrowing owl.

On May 5, 2004, HWA performed aerial and ground surveys to locate and document active raptor nests on and within a 1-mile buffer of the JRPA (HWA 2004c). All active and inactive raptor nests were documented. Previously documented raptor nest locations were obtained from the RFO. Ground surveys were conducted to verify activity status of some of the raptor nests identified from the air and to verify activity status of previously documented nests that were not observed from the air.

Based upon historical BLM data and HWA surveys in 2004, 33 raptor nests were documented within the survey area (HWA 2004c). One inactive ferruginous hawk nest was identified during the BLM onsite review in Section 32. Two active nests (1 golden eagle; 1 red-tailed hawk) were located in Section 7 of T19N:R89W. These nests were located on private land, but were observed from the public access county road (the Twenty Mile Road). These two active nests were located on a cliff less than ¼- mile from the proposed pipeline.

3.8.3 Special Status Species – Wildlife

Special status species include: (1) federally threatened, endangered, and candidate species listing by the FWS (Under the ESA of 1973 as amended). The FWS has determined that five wildlife species listed as either threatened, endangered, or candidate under the ESA may potentially be found on lands administered by the RFO. These species are the threatened bald eagle (*Halieaeetus leucocephalus*), endangered black-footed ferret (*Mustela nigripes*), threatened Canada lynx (*Lynx canadensis*), endangered Wyoming toad (*Bufo baxteri*), and the threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*). The only federally listed species found on RFO lands potentially occurring in the JRPA are the bald eagle, black-footed ferret, and Canada lynx (USDI-FWS 2003).

3.8.3.1 Threatened and Endangered Species – Wildlife

Black-footed Ferret and Associated White-tailed Prairie Dog Colonies

The black-footed ferret's original distribution in North America closely corresponded to that of prairie dogs (Hall and Kelson 1959, Fagerstone 1987). In Wyoming, white-tailed prairie dog (*Cynomys leucurus*) colonies provide habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food and they also use prairie dog burrows for shelter, parturition, and raising their young (Fagerstone 1987). Aerial surveys of prairie dog colonies were conducted over the JRPA by HWA between March 26 and April 3, 2001. Linear transects (1/4-mile spacing) were flown using a fixed-wing aircraft with GPS capabilities at an average altitude of 200 feet. One small prairie dog colony (2.2 acres) was located within the JRPA. Prairie dogs were observed during the aerial survey in Section 1, T18N:R91W, just west of the JRPA, but the colonies were not mapped because they were on private land. The potential for black-footed ferrets to occur within the JRPA is low due to the lack of suitable habitat. Additionally, the JRPA is located in an area of block clearance established by the FWS and WGFD for the black-footed ferret.

Canada Lynx

Records of lynx in Wyoming indicate that most lynx or lynx sign between 1973 and 1986 were in lodgepole pine (18%) and spruce-fir (41%) communities (Reeve *et al*. 1986). According to Reeve *et al*. (1986), more than 50 percent of lynx records in Wyoming occurred in the northwestern region of the state. No lynx sightings or sign have been documented in Carbon County since the late 1800's (Reeve *et al*. 1986).

Due to the facts that: (1) The JRPA does not include high elevation lodgepole pine/spruce-fir habitat types preferred by this species, (2) it does not support a population of snowshoe hares (preferred prey item), (3) there are no recorded lynx sightings near the JRPA, and (4) the closest potential habitat (lynx analysis unit (LAU)) is more than ten miles away in the Sierra Madre Mountains, it is unlikely that lynx occur on or near the JRPA.

Bald Eagle

Primary bald eagle wintering areas are typically associated with concentrations of food sources along major rivers that remain unfrozen whereby fish and waterfowl are available, and near ungulate winter ranges that provide carrion (Montana Bald Eagle Working Group 1990). Wintering bald eagles are also known to roost in forests with large, open conifers and snags protected from winds by ridges, often near concentrations of domestic sheep and big game (Anderson and Patterson 1988).

Incidental sightings of bald eagles have been recorded on and near the JRPA (WGFD 2003c). Two observations of bald eagles were recorded within the JRPA on October 21, 1992 and within one mile of the JRPA on January 18, 1984 (WGFD 2003c). No bald eagle nests or communal winter roosts are known to exist on or near the JRPA. Inspection of BLM and WGFD raptor nest records, and results of aerial and ground raptor nest surveys conducted by HWA, reveal that no bald eagle nests occur on or near the JRPA. It is possible that bald eagles may utilize the JRPA for foraging during winter and early spring, feeding on winter killed big game such as mule deer.

3.8.4 Species of Concern – Wildlife

The BLM has developed a sensitive species list for their lands managed in Wyoming. The objective of the sensitive species designation is to ensure the overall welfare of these species is considered when undertaking actions on public lands, and ensure they do not contribute to the need to list the species under the provisions of the ESA. It is the intent of this policy to emphasize the inventory, planning consideration, management implementation, monitoring, and information exchange for the sensitive species on the list. The BLM Sensitive Species List is meant to be dynamic and will be reviewed annually with recommendations from BLM biologists and appropriate non-BLM authorities for additions and deletions (USDI-BLM 2002). Twenty-eight species (6 mammals, 15 birds, 3 amphibians, and 4 fish) occur on the RFO Sensitive Species List. **Table 3-22** lists the species of concern potentially occurring in the JRPA.

Mammals

Six sensitive mammal species may potentially be found on or near the JRPA. These include: Wyoming pocket gopher, white-tailed prairie dog, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat. Only one of these species, the white-tailed prairie dog is known to occur within the JRPA; one small town (2.2 acres) occurs in Section 6, T18N:R90W. The remaining species: Wyoming pocket gopher, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat have a slight potential to occur on the JRPA.

Birds

Sixteen sensitive bird species may potentially be found on or near the JRPA. These include: mountain plover, Baird's sparrow, sage sparrow, Brewer's sparrow, long-billed curlew, sage thrasher, western burrowing owl, yellow-billed cuckoo, loggerhead shrike, Columbian sharp-tailed grouse, greater sage-grouse, white-faced ibis, trumpeter swan, peregrine falcon, ferruginous hawk, and northern goshawk. The western subspecies of yellow-billed cuckoo is considered a FWS candidate for listing as endangered. Eight of these species are known to be present or are likely to occur in the area of the JRPA and include: sage sparrow, Brewer's sparrow, sage thrasher, western burrowing owl, loggerhead shrike, greater sage-grouse, ferruginous hawk, and northern goshawk (not likely to nest on the JRPA, though). Six species: mountain plover, Baird's sparrow, Columbian sharp-tailed grouse, peregrine falcon, long-billed curlew, and white-faced ibis have a slight potential to occur on or near the JRPA. The yellow-billed cuckoo and trumpeter swan are unlikely to occur on or near the JRPA.

Mountain plovers prefer shortgrass prairie and desert shrub habitats (e.g. saltbush) with open, level or slightly rolling areas and vegetation under four inches in height (Graul 1975, Dinsmore 1981, Dinsmore 1983, Kantrud and Kologiski 1982). The JRPA was surveyed for potential mountain plover habitat in May, 2001 by HWA biologists. Areas with potential habitat for mountain plover were identified on the ground and mapped on 1:24,000 scale topographic maps. Additional surveys were conducted on potential habitat areas within the JRPA in the spring of 2001, 2002, and 2003. Surveys followed the 2001 Mountain Plover Survey Protocol developed by the RFO and the FWS. Three patches, totaling 113.3 acres, of potential mountain plover habitat were located within the JRPA boundary. The proposed pipeline would cross one patch of potential mountain plover habitat totaling 167 acres. No mountain plovers were sighted on the JRPA or along the pipeline during any of the surveys. However, HWA did locate a mountain

plover with young 20 miles north of the JRPA in 2004. Also, during on-site visits of the well locations, BLM biologists identified potential mountain plover habitat on a site specific basis.

Amphibians

Three sensitive amphibian species may potentially be found on or near the JRPA. These include: boreal toad, Great Basin spadefoot toad, and northern leopard frog. All three species have a slight potential to occur on the JRPA.

Fish

No fish are found in the JRPA due to lack of any perennial streams.

Table 3-22
Sensitive Wildlife and Fish Species Potentially Present on or near the JRPA

Common Name	Scientific Name	Sensitivity Status[2]	Occurrence Potential[3]
Mammals			
Wyoming pocket gopher	*Thomomys clusius*	R2, G2/S1S2, NSS4	Possible
White-tailed prairie dog	*Cynomys leucurus*	G4/S2S3, NSS3	Present
Swift fox	*Vulpes velox*	R2, G3/S2A3	Possible
Fringed myotis	*Myotis thysanodes*	R2, G5/S1B, S1N, NSS2	Possible
Long-eared myotis	*Myotis evotis*	G5/S1B, S1?N, NSS2	Possible
Townsend's big-eared bat	*Corynorhinus townsendii*	R2/R4, G4/S1B, S2N, NSS2	Possible
Birds			
Mountain Plover	*Charadrius montanus*	G2/S2B, SZN	Possible
Baird's sparrow	*Ammodramus bairdii*	G4/S1B, SZN, FSR2, TBNG	Possible
Sage sparrow	*Amphispiza belli*	G5/S3B, SZN	Present
Brewer's sparrow	*Spizella breweri*	G5/S3B, SZN	Present
Long-billed curlew	*Numenius americanus*	G5/S3B, SZN, R2, NSS3	Possible
Yellow-billed cuckoo	*Coccyzus americanus*	G5/S2B, SZN, FSR2, TBNG, NSS2	Unlikely
Sage thrasher	*Oreoscoptes montanus*	G5/S3B, SZN	Likely
Western burrowing owl	*Athene cunicularia*	R2, G4/S3B, SZN, NSS4	Likely
Loggerhead shrike	*Lanius ludovicianus*	G5/S4B, SZN, R2	Likely
Columbian sharp-tailed grouse			Possible
Greater sage-grouse	*Centrocercus urophasianus*	G5/S3	Present
White-faced ibis	*Plegadis chihi*	G5/S1B, SZN, R2, NSS3	Possible
Trumpeter swan	*Cygnus buccinator*	R2/R4, G4/S1B, S2N, NSS2	Unlikely
Peregrine falcon	*Falco peregrinus*	G4/T3/S1B, S2N, R2, NSS3	Possible
Ferruginous hawk	*Buteo regalis*	R2, G4/S3B, S3N, NSS3	Present

Common Name	Scientific Name	Sensitivity Status[2]	Occurrence Potential[3]
Northern goshawk	*Accipiter gentiles*	R2/R4, G5/S23B, S4N, NSS4	Likely
Amphibians			
Boreal toad	*Bufo boreas boreas*	G4T4/S2, R2, R4, NSS2	Possible
Great Basin spadefoot Toad	*Spea intermontanus*	G5/S4, NSS4	Possible
Northern leopard frog	*Rana pipiens*	G5/S3, R2, NSS4	Possible
Fish			
Roundtail chub	*Gila robusta*	G2G3/S2?, NSS1	Unlikely
Bluehead sucker	*Catostomus discobolus*	G4/S2S3, NSS1	Unlikely
Flannelmouth sucker	*Catostomus latipinnis*	G3G4/S3, NSS1	Unlikely
Colorado River cutthroat Trout	*Oncorhynchus clarki pleuriticus*	R2/R4, G4T2T3/S2, NSS2	Unlikely

[1] *- Source: USDI-BLM (2002), WYNDD (2003).*
[2] *- Definition of status*

***G** Global rank: Rank refers to the range-wide status of a species.*
***T** Trinomial rank: Rank refers to the range-wide status of a subspecies or variety.*
***S** State rank: Rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.*
***1** Critically imperiled because of extreme rarity (often known from 5 or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.*
***2** Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.*
***3** Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).*
***4** Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.*
***5** Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.*
***H** Known only from historical records. 1950 is the cutoff for plants; 1970 is the cutoff date for animals.*
***X** Believed to be extinct.*
***A Accidental or vagrant**: A taxon that is not known to regularly breed in the state or which appears very infrequently (typically refers to birds and bats).*
***B Breeding rank:** A state rank modifier indicating the status of a migratory species during the breeding season (used mostly for migratory birds and bats)*
***N Nonbreeding rank**: A state rank modifier indicating the status of a migratory species during the non-breeding season (used mostly for migratory birds and bats)*
***ZN or ZB** Taxa that are not of significant concern in Wyoming during breeding (ZB) or non-breeding (ZN) seasons. Such taxa often are not encountered in the same locations from year to year.*
***U** Possibly in peril, but status uncertain; more information is needed.*
***Q** Questions exist regarding the taxonomic validity of a species, subspecies, or variety.*
***?** Questions exist regarding the assigned G, T, or S rank of a taxon.*
***R2** Designated sensitive in U.S. Forest Service Region 2 (Rocky Mountain Region).*
***R4** Designated sensitive in U.S. Forest Service Region 4 (Intermountain Region).*

WGFD Native Species Status Codes - Fish and Amphibians
***NSS1** - Populations are physically isolated and/or exist at extremely low densities throughout range. Habitats are declining or vulnerable. Extirpation appears possible. The Wyoming Game and Fish Commission mitigation category for Status 1 species is "Vital". The mitigation objective for this resource category is to realize "no loss of habitat function". Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.*
***NSS2** - Populations are physically isolated and/or exist at extremely low densities throughout range. Habitat conditions appear to be stable. The Wyoming Game and Fish Commission mitigation category for Status 2 species is also "Vital". The mitigation objective for this resource category is to realize "no loss of habitat function". Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.*
***NSS3** - Populations are widely distributed throughout its native range and appear stable. However, habitats are declining or vulnerable. The Wyoming Game and Fish Commission mitigation category for Status 3 species is "High". The mitigation objective for this resource category is to realize "no net loss of habitat function within the biological community which encompasses the project site". Under these guidelines, it will be important that the project be*

conducted in a manner that either avoids the impact, enhances similar habitat or results in the creation of an equal amount of similarly valued fishery habitat.
***NSS4-7** - Populations are widely distributed throughout native range and are stable or expanding. Habitats are also stable. There is no special concern for these species.*

WGFD Native Species Status Codes - Birds and Mammals
***NSS1** - Populations are greatly restricted or declining, extirpation appears possible. AND On-going significant loss of habitat.*
***NSS2** - Populations are declining, extirpation appears possible; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; ongoing significant loss of habitat.*
***NSS3** - Populations are greatly restricted or declining, extirpation appears possible; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Species is widely distributed; population status or trends are unknown but are suspected to be stable; on-going significant loss of habitat.*
***NSS4** - Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance.*
***NSS5** - Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is stable and not restricted. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.*
***NSS6** - Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is stable and not restricted.*
***NSS7** - Populations are stable or increasing and not restricted in numbers and/or distribution; habitat is stable and not restricted.*

[3] - Occurrence potential based upon presence of suitable habitat, known distribution, WYNDD records, WGFD records, and field surveys.

3.9 RECREATION

Popular recreational activities commonly pursued on or near the JRPA include hunting, camping, and off-road vehicle use. There are no developed recreational sites, facilities, or special recreational management areas within or adjacent to the JRPA. The fall hunting season attracts the majority of recreational use. The greater sage-grouse season in September and October attracts small game hunters. In addition, pronghorn hunting also occurs in September and mule deer hunting occurs in mid to late October. Rabbits and some predators are hunted during the fall and winter. Outside designated hunting seasons, a small number of visitors are attracted to this area for other recreational activities. These activities include: hiking, wildlife viewing and sightseeing, rock collecting, outdoor photography and picnicking. Data on recreational visitation are not available. A variety of factors, such as small number of local residents, long distances from major population centers, lack of publicized natural attractions, road conditions, and checkerboard land ownership patterns limit access to the area. These factors have resulted in low visitation to the JRPA.

3.10 VISUAL RESOURCES

The objective of BLM visual resource management is managing and protecting visual resource values in accordance with Section 102(a) (8) of the Federal Land Policy and Management Act of 1976. The rating of visual resource values takes into consideration scenic qualities, sensitivity levels, and a delineation of distance zones.

The JRPA is located in a BLM visual resource management Class III area, which is managed to partially retain the existing character of the landscape. Management activities taking place in this class may modify the landscape, but should not dominate the views.

Views in the JRPA are enhanced by the open, treeless, and hilly topography. Ridges and high points allow the observer a view that stretches for miles across the vast JRPA. These views encompass distant ridges with some timber, ranch dwellings, and drainages.

Vegetation in the JRPA is typical for this part of Wyoming, consisting mostly of low sagebrush and grasses, with the drainages containing some larger sagebrush and rabbitbrush. These plant communities provide different colors throughout the seasons. If precipitation is ample, the spring green provides a striking contrast to the grey sagebrush of winter. Late summer and fall grasses turn to rust and brown as the growing season ends. The seasonal changes in vegetation color are noticed by the casual observer, and are enhanced by the ability to view long distances in the JRPA.

Some cultural modification has occurred in the JRPA, consisting of the Fillmore Ranch and unimproved roads. Some oil and gas wells can also be viewed in the area. Twentymile Road is the only public access into the area, and motorists traveling along this route would be able to view the JRPA.

3.11 CULTURAL RESOURCES

3.11.1 Cultural Chronology of Area

Archaeological investigations in the Washakie Basin indicate the area has been inhabited by prehistoric people for at least 10,000 years from Paleoindian occupation to the present. The accepted cultural chronology of the Washakie Basin is based on a model for the Wyoming Basin by Metcalf (1987) and revised by Thompson and Pastor (1995). The Wyoming Basin chronology is documented in **Table 3-23**.

Table 3-23
Prehistoric Chronology of the Wyoming Basin

Period	Phase	Age (B.P.)
Paleoindian		12,00-8,500
Early Archaic	Great Divide	8,500-6,500
	Opal	6500-4300
Late Archaic	Pine Spring	4300-2800
	Deadman Wash	2800/1800-650
Late Prehistoric	Uinta	2000/1800-650
	Firehole	650-300/250
Protohistoric		300/250-150

from Metcalf (1987), as modified by Thompson and Pastor (1995)

Paleoindian Period

The oldest period for which there is solid archaeological evidence is the Paleoindian, beginning ca. 12,000 B.P. and ending around 8500 B.P. This is the transition period from the periglacial conditions of the Wisconsin ice advance during the terminal Pleistocene to the warmer and drier conditions of the Holocene. Paleoindian sites are rare in southwest Wyoming. However, isolated Paleoindian projectile points are not uncommon.

Archaic Period

Settlement and subsistence practices, in southwest Wyoming, remained largely unchanged from the end of the Paleoindian period through the Archaic and continued until at least the introduction of the horse. Reduced precipitation and warmer temperatures changed the environment. The Archaic Period dates from 8,500 B.P to 2,000 B.P. The Archaic period is divided into early and late periods. The early periods are the Opal and Great Divide. The late period is divided into the Pine Spring and Deadman Wash phases. These periods are characterized by a greater use of plant material.

Late Prehistoric Period

The late Prehistoric period is divided into the Uinta and Firehole phases. This period is highlighted by the increase in seed processing and the introduction of the bow. A unique characteristic of the Uinta phase is the use of subterranean structures dating to ca. 1500 B.P.

Protohistoric Period

The Protohistoric period begins sometime after 300 years B.P. with the first European trade goods to reach the area, and end with the development of the rocky Mountain fur trade 150 years ago. The most profound influence on native cultures during this period was the introduction of the horse, which allowed Native Americans to expand their range.

Historic use of the area was limited by the formidable topography and harsh weather. Some grazing occurred and is recognized by some isolated ranch dwellings. However, historic trails were utilized near the JRPA. The Rawlins to Baggs Stage Road is located near the JRPA and was utilized for moving freight, mail, and passengers between Rawlins, Baggs, and into Colorado. The route was first utilized in 1881 and was known as the Rawlins to White River, the Rawlins, and the Snake River Road (BLM 2004). Stage stations were established along the route, and included service to ranching communities in the Little Snake River Valley.

3.11.2 CULTURAL RESOURCE SUMMARY

A Class 1 Wyoming State Historic Preservation Office (SHPO) file search was completed for the JRPA. A total of six previous field surveys (Class III Intensive Survey) have been completed within or close to the JRPA, resulting in the identification of five sites. All of these sites were either not eligible or had unkown status with regards to eligibility for the NRHP.

3.11.3 JOLLY ROGER PROJECT CULTURAL RESOURCE SURVEY RESULTS

The Class III Intensive Survey identified 5 cultural resource sites in the JRPA. These sites included two sheep herder camps, two lithic scatter sites, and a sheep herder cairn. None of these sites were identified as eligible for the NRHP.

3.12 SOCIOECONOMICS

The geographic area of analysis for potential socioeconomic effects is Carbon County, Wyoming, and the nearest communities of Baggs, Dixon, and Rawlins. Socioeconomic conditions in Carbon County that were characterized for the assessment include economic and population conditions, temporary housing resources, certain local and state government revenues, and local attitudes and opinions.

3.12.1 Economic Conditions

The economy of Carbon County is based on natural resources. Basic economic sectors that bring revenues in the county include: oil and gas extraction and processing, coal mining, electric power generation, agriculture (primarily ranching and logging), some manufacturing, and transportation (primarily the Union Pacific railroad). Those portions of the retail and service sectors that serve tourism and recreation visitors are also basic.

Employment and earnings are two common measures of economic activity. The mining sector, which includes oil and gas employment, would be the primary sector affected by exploration or development of CBNG resources.

Employment, like the overall economy, has followed a boom and bust cycle. In 2002, employment in Carbon County totaled 12,392 full-and part-time jobs, which was about 25 percent higher than the 1990 level (Wyoming Department of Administration and Information [WDAI] 2000a, WDAI 2003) and about 9 percent lower than the 1980 level of 13,350 jobs. Employment in the mining sector, which includes jobs in the oil and gas industry, decreased 73 percent from 1990 to 2001, from 934 to 256 jobs. The 2001 level was 93 percent lower than the 1980 level of 3,563 mining jobs (University of Wyoming [UW] 1997). The losses in the mining sector and the volatility in total employment are attributed to the shutdown of the Rosebud and Seminoe #2 mines (BLM 1999). Recently, the RAG Shoshone mine near Hanna has closed (Rawlins Daily Times 2000). Other reductions in the mine workforce and the delay in opening an anticipated mine have further affected employment in the mining sector throughout the county; however, increases in natural gas drilling has resulted in employment growth in the region in recent years.

In Carbon County, 10-year unemployment rates ranged from a low of 4 percent (2000) to a high of 6.1 percent (1993). The total 2002 labor force in Carbon County was 8,038, which included 366 unemployed persons, resulting in an unemployment rate of 4.6 percent (Wyoming Department of Employment 2003).

Carbon County tax earnings increased from 202 million to 211 million between 1990 and 1998, a 5 percent increase. However, when adjusted for inflation, earnings in Carbon County decreased by 21 percent from their 1990 level during the 8-year period.

3.12.1.1 Oil and Gas Activities

Production of natural gas in Carbon County increased from 76 million cubic feet (MCF) in 1995 to almost 98,100,000 MCF in 2002. In addition, 2002 production of oil in Carbon County was 1,714,000 BBLS. During 2002, there were 1,191 producing oil and gas wells in Carbon County (WOGCC 2002).

One indicator of future production, approved APDs, increased steadily in Carbon County in recent years, from 50 in 1995, 162 in 2000, 280 in 2003, and 151 to date in 2004 (WOGCC 2004). Increased drilling may result in increased production in the county if drilling efforts are successful and commodity prices rise or stabilize at economic levels.

3.12.1.2 Economic Activities

Other economic activities occurring in and near the JRPA include: oil and gas exploration, cattle grazing, and outdoor recreation such as hunting (pronghorn antelope, mule deer, elk and upland birds), hiking, off-road vehicle use, camping, and sightseeing. There are 15 commercial hunting outfitters that hold permits for the hunting units (elk hunt area 108, deer hunt area 84, and antelope hunt area 55) located in the JRPA. The JRPA makes up only a small portion of these hunting units (Wyoming Board of Outfitters 2004).

3.12.1.3 Population

The growth and decline in the population of Carbon County parallel the employment boom and bust cycle outlined at the beginning of this section. For example, the 2000 population of Carbon County (15,639) was 29 percent lower than its 1980 level of 21,896 (WDAI 2001). Between 1990 and 2000, the City of Rawlins, the largest community in Carbon County, lost an estimated 842 persons to end the period at 8,538 (Table 3-23). However, the city has recently added population because a new state prison opened. During this period, the Town of Baggs gained 76 residents or 28 percent of its 1990 population. Likewise, the Town of Dixon, several miles east of Baggs, gained 12 persons to end the period with an estimated population of 79. The largest population centers in Carbon County are listed in **Table 3-24**

Table 3-24
Population Centers

		Population		
County	**City**	**1990**	**2000**	**% Change**
Carbon	Rawlins	9,380	8,538	-9.0
	Saratoga	1,969	1,726	-12

3.12.2 Temporary Housing Resources

Natural gas development typically involves relatively short-duration tasks carried out primarily by contractors. The nature of these activities results in demand for temporary housing resources such as motel rooms, mobile homes, and recreational vehicle (RV) spaces in the JRPA and vicinity.

The most convenient access to the JRPA would be from communities located along I-80 in Carbon and Sweetwater Counties. Rawlins is the county seat of Carbon County and the community nearest to the JRPA. Temporary housing includes 20 hotels and four RV parks. Hotels and RV parks routinely accommodate oil and gas industry workers, as well as tourists, travelers, and hunters. Long-term rental housing in the Rawlins area consists of 10 apartment complexes and numerous rental houses. According to the 2000 Census, 17.3 percent, or 667 housing units, of the total 3,860 housing units were rental vacancies.

3.12.3 Local Government and State Government Revenues

The fiscal condition of local and state governments most likely to be affected by interim drilling includes: County, school, and special district ad valorem property tax revenues; state, county, and municipal sales and use tax revenues; state severance taxes; and federal and state mineral royalty distributions. Some county, municipal, and special district service expenditures may also be minimally affected.

3.12.3.1 Ad Valorem Property Tax

The assessed valuation in Carbon County for fiscal year (FY) 2003 totaled about $382 million, which yielded total property tax revenues of $24.5 million. Mineral production is assessed at 100 percent of value. The countrywide mill levy (including countywide and special districts) in 2003 was 4.9 million. Assessed valuation in FY 2003 from 2002 natural gas production totaled $198.9 million, or about 88 percent of total assessed valuation. Assessed valuation from oil production totaled $30.5 million, or about 13 percent of total assessed valuation (Wyoming Tax Payers Association [WTA] 2003).

3.12.3.2 Sales and Use Tax

FY 2003 sales and use tax collections in Carbon County totaled about $14.5 million. These collections include a 4 percent state sales tax, and a 1 percent general purpose local-option sales tax (WTA 2003)

3.12.3.3 Severance Taxes

In Wyoming, severance taxes are levied against certain minerals produced in the state, including a 6 percent severance tax on natural gas. In FY 2003, distributions from the severance tax totaled $429 million (WDAI 2004).

3.12.3.4 Federal Mineral Royalties

The federal government collects a 12.5 percent royalty on oil and natural gas extracted from federal lands. After certain costs are deducted, half of those royalties are returned to the state where production occurred. In Wyoming, the state's share is distributed to a variety of accounts, including the university, school foundation fund, highway fund, Legislative Royalty Impact Account, and cities, towns, and counties. During FY 2003, $476 million in federal mineral royalty funds were distributed to entities in Wyoming (WDAI 2004).

3.12.3.5 State Mineral Royalties

The State of Wyoming collects a 16.7 percent royalty on the fair market value of gas produced from state leases, less production, and transportation costs. During FY 2003, income from state leasing was 52 million (WDAI 2004).

3.12.4 Attitudes and Opinions

A 1996 survey conducted in conjunction with preparation of the Carbon County Land Use Plan provides some insight into the attitudes and opinions of residents regarding land use, oil and gas development, natural resource conservation, and use and other topics. Slightly more than 300 residents completed the survey, yielding an estimated statistical reliability of about 95 percent (Pederson Planning Consultants 1998). Water resource conservation and concern for government regulation of land use were the most frequently listed important land use issues. This issue was followed closely by the availability of water to support future land uses; the economic viability of ranching, timber, and oil and gas industries; and the need to conserve wildlife habitat.

Approximately 55 percent of the countywide survey respondents (based on a weighted average; some respondents indicated more than one response) indicated that conservation of land, water, and wildlife resources was more important than increased oil and gas production, while 36.9 percent indicated that increased oil and gas production was more important. However, 54 percent of the respondents from Baggs indicated that increased oil and gas production was more important than conservation of land, water, and wildlife resources, while 36 percent indicated that resource conservation was more important. The land use plan attributes the difference to the greater economic dependence in Baggs on future employment in the oil and gas industry.

Concerning management of federal lands, the largest number of respondents (69.5 percent) indicated that more federal lands within the county should be designated for conserving fish and wildlife habitat and water resources. In addition, 60.8 percent of respondents indicated that more land should be designated for public recreation, 48.8 percent indicated that more land should be leased for oil and gas industry exploration and production, 48.7 percent indicated that more land should be leased for commercial mining, and 44.5 percent indicated that more land should be made available to local timber companies for commercial timber harvest.

3.13 TRANSPORTATION

The regional transportation system that serves the JRPA includes an established network of interstate and state highways and county roads. Improved and unimproved BLM roads serve local traffic on federal land. The JRPA would be accessed from Carbon County Road (CCR) 605 (Twentymile Road), which connects I-80 on the west side of Rawlins. CCR 605 is a one-lane road that is graded and partially graveled.

3.14 HEALTH AND SAFETY

Health and safety concerns include occupational hazards associated with natural gas operations. Two types of workers are employed in oil and gas fields: oil and gas workers, who had a 2002 non-fatal accident rate of 3.8 per 100 workers, and special trade contractors, who had a 2002

non-fatal accident rate of 7.4 per 100 workers (U.S. Department of Labor, Bureau of Labor Statistics 2002). In addition to occupational hazards associated with gas operations and exploration, there are health and safety risks associated with vehicular travel on improved and unimproved county and BLM roads; firearms accidents associated with hunting or casual use of firearms; and low-probability events such as landslides, flash floods, and range fires.

3.15 HAZARDOUS WASTE

Bureau of Land Management Instruction Memoranda Numbers WO-93-344 and WY-94-059, require all NEPA documents to list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a Proposed Action. Hazardous materials, as defined herein, are those substances listed in the EPA's Consolidated List of Chemicals Subject to reporting Under Title III of the SARA of 1986, and extremely hazardous materials are those identified in the EPA's List of Extremely Hazardous Substances (40 CFR 355). No hazardous substance, as defined by the CERCLA, will be used in the construction or drilling operations associated with these wells. Additionally, no RCRA hazardous wastes will be generated by well-drilling operations.

3.16 NOISE

The JRPA is located in a rural setting, which is sparsely populated. The only noise created above normal background levels is created by nearby drilling, a compressor station, and localized vehicular traffic on roads can also cause sound disturbances within the JRPA.