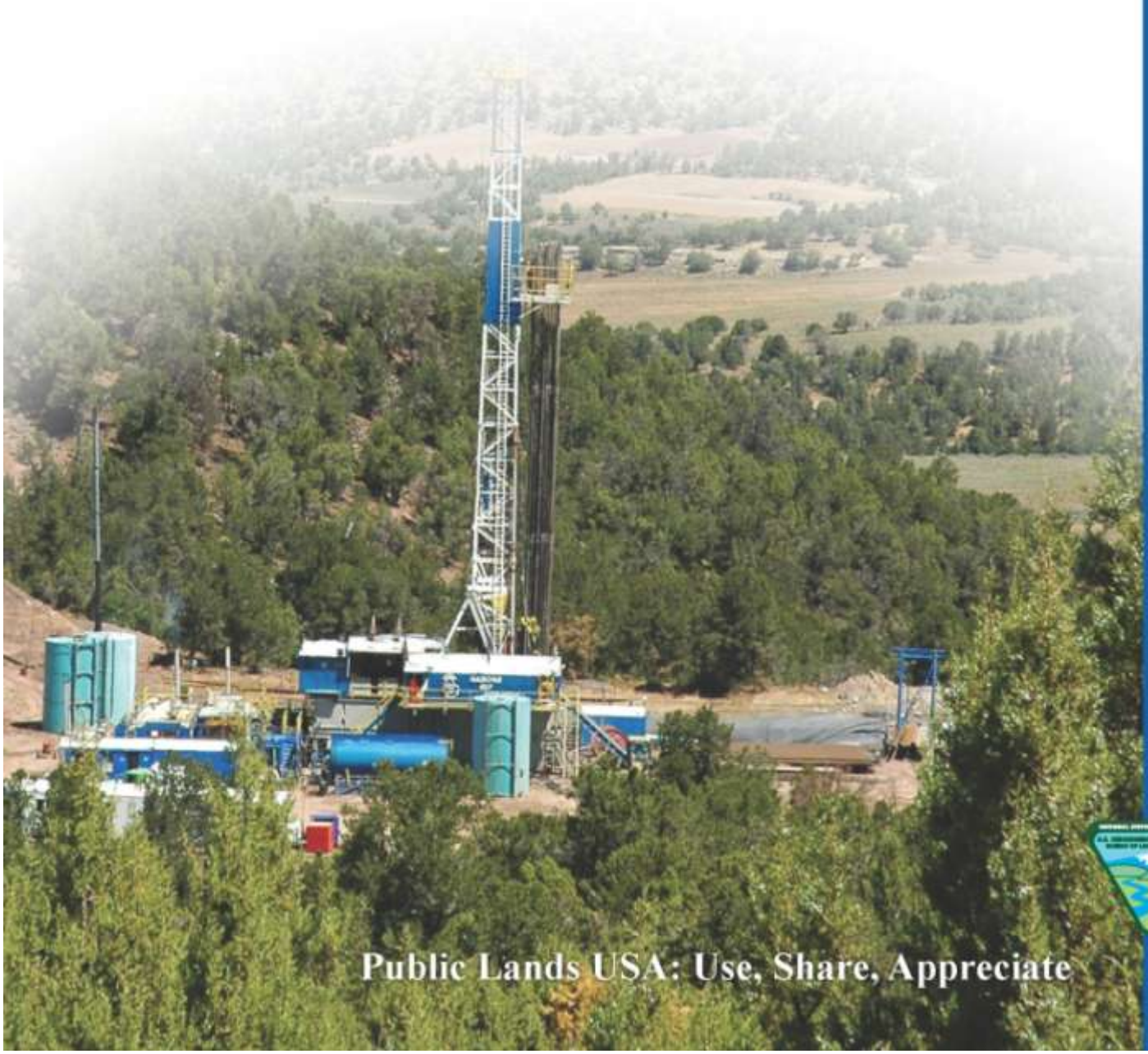
BLM

Chapter 3

Affected Environment



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CHAPTER 3
AFFECTED ENVIRONMENT

3.1 Introduction

Chapter 3 describes existing conditions for BLM resource programs, resource uses, special designations, other management areas, and the socioeconomic environment within the WRFO Planning Area. Management of resources and resource uses on public lands administered by the BLM is directed by a variety of laws, regulations, policies, and other requirements. The WRFO also considers BMPs in the management of resources and resource uses in the WRFO Planning Area. Appendix B identifies potential BMPs.

In addition to describing existing conditions, Chapter 3 identifies, where appropriate, management challenges for resource programs and resource uses on BLM-administered land. These management challenges were identified by the BLM's AMS (BLM 2007b), as well as by issues identified during the 2006 scoping process for amending the 1997 White River RMP (BLM 1997a). For example, BLM has identified challenges for management of air quality in the WRFO Planning Area. These management challenges are based, in part, on historic activities and current conditions and trends. By describing existing conditions for resource programs in the WRFO Planning Area, this chapter serves as the baseline against which the impacts of the different alternatives are analyzed and compared in Chapter 4. Maps 3-1 through 3-21 are located at the end of the chapter.

3.1.1 Overview of the WRFO Planning Area

The WRFO administrative office is located in the town of Meeker in northwestern Colorado. The BLM WRFO-administered public lands include all but a small portion of Rio Blanco County, with additional small tracts located in northern Garfield County and southern Moffat County. The FS administers approximately 376,100 acres of the 2.3 million acre White River National Forest (WRNF) in Rio Blanco and Garfield counties. Also contained within the WRFO Planning Area boundary are National Park Service, state, and private lands. Table 1-1 in Chapter 1 presents a summary of land ownership which also includes FS, state, and private lands in Rio Blanco, Moffat, and Garfield counties.

The western portion of the WRFO Planning Area lies within the Colorado Plateau physiographic province, which is characterized by dissected plateaus with strong relief. The eastern portion of the WRFO Planning Area lies in the Southern Rocky Mountains physiographic province. The Grand Hogback, a monoclinal structure of steeply dipping sedimentary rocks, traverses the area in a general north-south direction and divides these two major provinces. East of the Grand Hogback, in the White River Uplift, land elevations range from about 6,000 to 12,000 feet.

The WRFO Planning Area is primarily comprised of pinyon/juniper woodland at elevations from 6,000 to 9,000 feet with average annual precipitation between 11 to 16 inches. The climate of the WRFO Planning Area is classified as semiarid with a wide variation in daily and annual temperatures due to relatively high elevation and dry air. Summer temperatures average approximately 60 degrees Fahrenheit and winter temperatures average approximately 27 degrees Fahrenheit.

Soils and vegetation in the WRFO Planning Area generally provide rangeland suitable for year-round cattle and sheep grazing at lower elevations; however, supplemental feeding is often required, especially at higher elevations.

Rio Blanco County
Rio Blanco County was established in 1889 in response to the early gold rush of the 1860s and 1870s and the subsequent mining boom. Today, energy development and resource extraction, agriculture, and recreation remain important to the area economy.

The county seat and largest city in Rio Blanco County is Meeker. The population at the 2000 Census was 5,986 (Rio Blanco County 2007). The BLM-administered lands in the northeast corner of Rio Blanco County are administered by the Little Snake Field Office (LSFO) in Craig.

The White River generally runs in an east-west direction through Rio Blanco County. Other major tributaries located in Rio Blanco County include Piceance Creek and Douglas Creek.

Colorado State Highway (SH) 64 generally bisects Rio Blanco County, traversing west to east along the White River from Dinosaur in Moffat County to Meeker. Major south-north roads include SH 13 from Rifle to Meeker, and eventually to Craig, county seat of Moffat County and a rail yard/head that often serves Rio Blanco County; and SH 139 from Loma to Rangely.

Garfield County
Garfield County was founded in 1883. Like Rio Blanco County, Garfield County was settled in response to the gold rush and mining boom. In 1887, the Denver and Rio Grande Railroad extended service to Glenwood Springs, thus providing an economical way to transport products to market. Today, energy development, tourism, ranching, and farming are the main industries.

The county seat is Glenwood Springs. The population at the 2000 Census was 43,713 (Garfield County 2008). The BLM Grand Junction Field Office and Glenwood Springs Field Office administer the majority of BLM lands within Garfield County.

The Colorado River generally traverses in an east-west direction through the eastern half of Garfield County. Water bodies in Garfield County within the WRFO Planning Area include Trappers Lake and the headwaters of the White River; upstream portions of Piceance Creek and several of its tributaries; the east and west forks of Douglas Creek; and the headwaters of Parachute and Roan Creeks, which drain directly into the Colorado River.

Interstate 70 (I-70) is the main thoroughfare through Garfield County in the east-west direction. State Highway 13 is the main north-south highway in Garfield County, traversing from Meeker to Rifle, and SH 139 runs in a north-south direction from Rangely to Loma.

Moffat County
Moffat County was established in 1911. Similar to Rio Blanco and Garfield counties, Moffat County was settled in response to resource extraction booms. Today, agriculture and mining are the main industries in Moffat County. The county seat is Craig. The population in the 2000 Census was 13,184 (U.S. Census Bureau 2008). The majority of BLM lands in Moffat County are administered by the LSFO.

There are three main rivers in Moffat County. The Green River is located in the northwestern corner of the county and crosses the Utah border. The portion of the Green River within Colorado is mostly within Dinosaur National Monument. The Yampa River flows in an east-west direction and generally bisects the county. The Little Snake River runs in a northeast to southwest direction from the Wyoming border and flows into the Yampa River. In Moffat County, the WRFO administers BLM lands on which several tributaries flow to the White River, including Wolf Creek.

The main east-west thoroughfare through Moffat County is U.S. Highway 40 (U.S. 40) from Craig to Dinosaur. State Highway 13 traverses the county in a north-south direction connecting I-80 in Wyoming to Meeker.

3.2 Physical Resources

3.2.1 Air and Atmospheric Values

This section describes the climate and typical ambient air quality conditions (i.e., existing air quality) in the region potentially affected by alternatives described in Chapter 2. Air pollutants addressed in this Draft Oil and Gas Development RMPA/EIS include greenhouse gases, criteria pollutants, HAPs, and compounds that could cause visibility impairment or atmospheric deposition. Regional air quality is influenced by the interaction of several factors, including meteorology, climate, the magnitude and spatial distribution of local and regional air pollutant sources, and the chemical properties of emitted air pollutants.

3.2.1.1 Climate

The WRFO Planning Area is primarily comprised of pinyon/juniper woodland at elevations from 6,000 to 9,000 feet with average annual precipitation between 11 to 16 inches. Further east is the Flat Tops Wilderness Area, a large elevated and flattened dome plateau ranging from nearly 9,000 to just over 12,000 feet. The complex terrain causes considerable climatic variability because elevation, slope, and aspect affect precipitation and temperatures. Precipitation at lower elevations is typically distributed fairly evenly throughout the year at nearly one inch per month, with mid-winter receiving the lowest average amounts and spring and fall the highest levels. Table 3-1 provides average temperature and annual precipitation measurements. Representative temperature and precipitation data were obtained from the Western Regional Climate Center (WRCC) (WRCC 2008a).

Table 3-1. Average Annual Temperature and Precipitation

Station Name[1]	Station ID[2]	Annual Temperature		Annual Precipitation		County
		Minimum (°F)[3]	Maximum (°F)	Total (in)[4]	Snow (in)	
Dinosaur National Monument	52286	33.4	61.5	11.60	40.2	Moffat
Little Hills	55048	24.0	60.7	13.82	56.7	Rio Blanco
Meeker	55484	27.4	60.4	16.43	69.6	Rio Blanco
Rangely	56832	30.9	62.9	9.99	26.2	Rio Blanco
Yampa	59265	25.4	53.6	16.36	120.1	Routt

SOURCE: WRCC 2008a.

NOTES:

[1]The period of record for each station is:
Dinosaur National Monument: 6/1/1965–12/31/2006
Little Hills: 7/1/1946–9/30/1991
Meeker: 1/1/1893–12/31/2006
Rangely: 7/1/1894–12/31/2006
Yampa: 3/1/1909–12/31/2006

[2]ID = identification number

[3]°F = degrees Fahrenheit

[4]in = inches

Representative wind measurements are limited within the WRFO administrative boundary. Table 3-2 shows wind data collected by the CDPHE at the Piceance Basin Bar-D station, which is located within WRFO jurisdiction. The wind tends to blow from the south southeast in the spring and more from the south during summer and fall. Average wind speed is highest in the spring, with highest peak gusts occurring in January through July.

Table 3-2. Piceance Basin (Bar-D) Wind Data Summary (Years 2002–2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg[1]
DIR[2]	S[3]	SSE[4]	SSE	SSE	SSE	SSE	S	SSE	S	S	S	S	SSE
SPD[5]	7.1	7.4	8.5	9.6	8.9	8.8	7.8	7.9	8.1	7.6	7.4	7.2	8.0
PGU[6]	30.0	31.8	27.3	29.3	29.3	29.8	31.5	28.2	26.8	26.8	24.2	23.9	31.8

SOURCE: Data recorded from January 1, 2002 through March 15, 2007 (CDPHE APCD 2007).

NOTES:

[1]Avg = Annual Average

[2]DIR = prevailing wind direction (in compass points)

[3]S = south

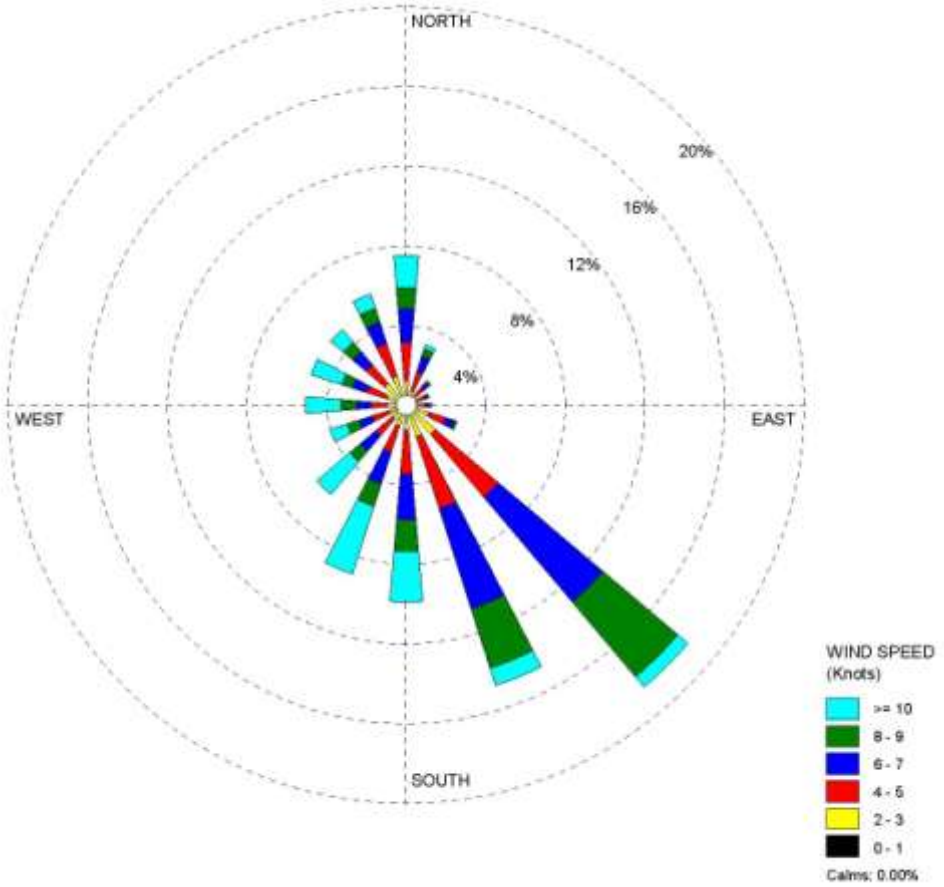
[4]SSE = south southeast

[5]SPD = mean wind speeds (miles per hour)

[6]PGU = peak gust (mph)

Figure 3-1 illustrates wind speed in knots and direction based on data collected at the Bar-D meteorological monitoring station in the Piceance Basin. The position of the bars indicates the direction from which wind originates. The length of each bar is proportional to the frequency of time that wind blows from that direction. Each bar is further broken down into segments showing the frequency of wind speed occurrences. At the Bar-D monitoring station, wind originates from the southeast approximately 17.7 percent of the time based on the total length of the southeasterly bar. As shown by the length of each colored segment of this bar, the wind originates from the southeast and has a wind speed of 2–3 knots 1.8 percent of the time, 4–5 knots 4.0 percent of the time, 6-7 knots 6.7 percent of the time, 8–9 knots 4.8 percent of the time, and greater than 10 knots 0.4 percent of the time. In contrast, the wind blows from the east-southeast 1.8 percent of the time and the wind speed from that direction never exceeded seven knots.

Figure 3-1. Bar-D Wind Rose



SOURCE: CDPHE APCD 2007.
NOTE: Data recorded from January 1, 2002 through March 15, 2007.

3.2.1.2 Air Quality

The Clean Air Act (CAA) requires the EPA to set National Ambient Air Quality Standards (NAAQS) for seven criteria pollutants that are considered harmful to public health and the environment. The CAA established two types of air quality standards (primary and secondary). Primary standards set limits necessary to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection of the general environment, as well as preventing damage to animals, crops, vegetation, and buildings.

The Federal NAAQS are implemented by state agencies with EPA oversight. The State of Colorado has adopted all of the NAAQS. In addition, Colorado has adopted a 3-hour sulfur dioxide (SO_2) standard of 700 micrograms per cubic meter ($\mu g/m^3$). Six criteria pollutants have been monitored in or near the WRFO Planning Area: (1) CO, (2) nitrogen dioxide (NO_2), (3) ozone, (4) respirable particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$), (5) respirable particulate matter less than 10 microns in effective diameter (PM_{10}), and (6) SO_2. Due to low emissions of lead in the WRFO Planning Area, no monitoring data have been collected for this criteria pollutant.

The CDPHE provided ambient background concentration data to be used for modeling air quality in the WRFO Planning Area. Reported in micrograms per cubic meter ($\mu g/m^3$), these background data are presented in Table 3-3, which includes ambient air concentrations from monitors located inside and outside the WRFO administrative boundary. Concentration data collected within the Piceance Basin includes CO data collected at the American Soda Plant monitor and SO_2 data collected at the Unocal monitor. Background concentration data for other pollutants was collected outside of the WRFO Planning Area. Table 3-3 also presents national and state air quality standards for each of the criteria pollutants monitored in the WRFO area. The maximum pollutant concentrations are below applicable Colorado Ambient Air Quality Standards (CAAQS) and NAAQS, respectively, for all pollutants except ozone. Ozone levels approaching, but not exceeding the federal standard have been observed. The cause of observed high ozone levels is uncertain, although regional transport, "cold pool" ozone formation, or subsidence of stratospheric ozone is possible (see further discussion below).

Table 3-3. Background Concentrations

Pollutant	Averaging Time[1]	Maximum Measured Background Concentration (µg/m)	NAAQS (µg/m)	CAAQS (µg/m)	PSD[2] Class I Increments (µg/m)	PSD Class II Increments (µg/m)
CO[3]	1-hour	1,145	40,000	40,000	NA[4]	NA
	8-hour	1,145	10,000	10,000	NA	NA
NO_2[5]	Annual	9	100	100	2.5	25
Ozone	1-hour [6]	173	235	235	NA	NA
	8-hour [7]	145	157	157	NA	NA
$PM_{2.5}$[8]	24-hour	18	35	65	NA	NA
	Annual	8	15	15	NA	NA
PM_{10}[3]	24-hour	41	150	150	8	30
	Annual	11	50	50	4	17
SO_2[9]	3-hour	24	1,300	700	25	512
	24-hour	13	365	365	5	91
	Annual	5	80	80	2	20

SOURCE: CDPHE APCD 2006a.

NOTES:

[1] Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

[2] PSD = Prevention of Significant Deterioration Program

[3] Data collected by American Soda, Piceance Basin, 2003-2004

[4] NA = not applicable

[5] Based on data collected by Southern Ute Indian Tribe at Ignacio, CO

[6] Data collected by the National Park Service at Mesa Verde, 2003

[7] Based on data collected by the Clean Air Status and Trends Network (CASTNET) Network at Gothic and Mesa Verde, CO, and Canyonlands, UT

[8] Data collected in Grand Junction, CO (515 Patterson)

[9] Data collected by Unocal, Piceance Basin, 1983-1984

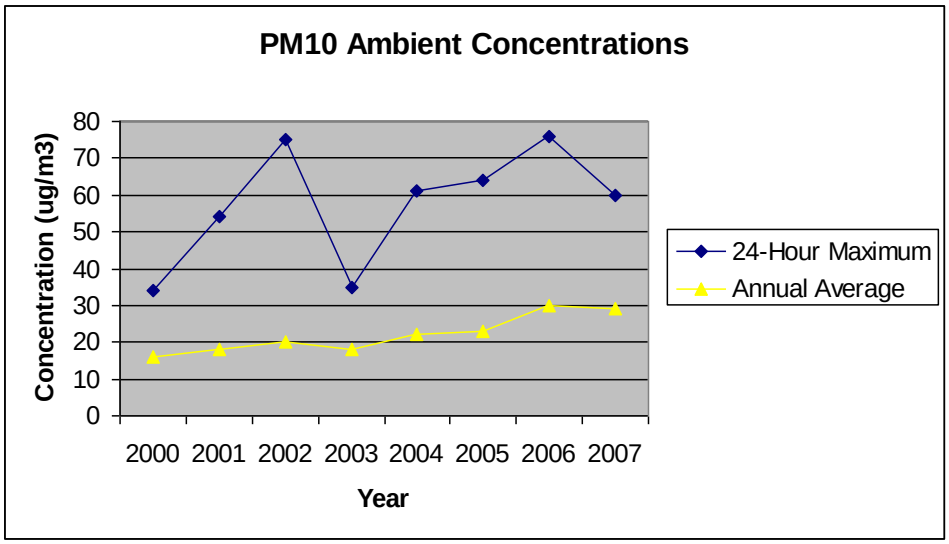
Based on the monitoring data that is available in and near the WRFO Planning Area, air quality is good (substantially below the NAAQS for all pollutants except ozone), due to relatively few large air pollutant emission sources. With regard to large non-gas industrial sources, there are no petroleum refineries, electric utility power plants, or major manufacturing facilities in the WRFO

Planning Area. Oil and gas wells, gas pipelines, compressor stations, gas plants, and agricultural activities are prevalent. People live in small communities and isolated ranches. Good atmospheric dispersion conditions due to reliable winds and vertical mixing, as well as limited air pollutant transport into the area, result in relatively low local air pollutant concentrations. Based on the data shown in Table 3-3, the air quality within the WRFO Planning Area complies with the applicable air quality standards.

In May 2005, a two-year air quality monitoring study was initiated by the Garfield County Public Health Service (documented in a report entitled Status of Garfield County Air Quality Monitoring Program) to collect ambient air quality data for PM_{10} and VOCs. Results from this effort show generally low PM_{10} concentrations and very low VOC concentrations (Garfield County Public Health Service 2007).

Figure 3-2 shows the PM_{10} data collected over an eight-year period at the Parachute Monitoring Station located in Garfield County. Data are shown for both the 24-hour maximum and annual average.

Figure 3-2. PM_{10} Ambient Concentrations



SOURCE: EPA 2008.

Recent ozone monitoring data from the Rangely, Colorado monitor indicate periods of elevated winter ozone concentrations within the WRFO planning area. The three highest daily maximum 8-hour averages in 2011 at the Rangely monitor were above the 75 ppb NAAQS and were measured at 88 ppb, 88 ppb, and 81 ppb on February 13, 14 and 15 of 2011. In Utah's Uinta Basin (located in eastern Utah and a portion of western Colorado), 8-hour daily maximum winter ozone exceedances have been measured at the Ouray and Redwash monitoring stations between 2009 and 2011. This winter ozone pattern is similar to ozone monitoring observations made in other oil and gas fields including the Upper Green River Basin and Jonah-Pinedale Anticline. The EPA issued a final rule on April 30, 2012, designating Duchesne and Uintah counties in Utah as an ozone unclassifiable area. The current scientific consensus is that the photochemical processes that form tropospheric ozone in the presence of NO_2 and free radical volatile organics are heightened by increased concentrations of ozone precursors from the stagnant winter atmospheric conditions and increased solar radiation reflected from the winter snow cover. However, this is an area of ongoing scientific research.

Visibility

Visibility within the Planning Area is measured under the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Visibility measurements for the Flat Tops Wilderness Area are recorded by the WHRI1 monitor, which is the closest visibility monitor and is located approximately 57 miles southeast from the boundary of the Flat Tops Wilderness Area within the White River National Forest. The WHRI1 monitor has been specifically designated by the EPA as the monitor to be used for determining visibility impacts at the Flat Tops Wilderness Area. Impairment to visibility is measured in deciviews (dv). The deciview scale indicates visibility impairment or haziness due to light extinction. The deciview scale is a logarithmic scale (similar to acoustic decibels). An increase of one deciview indicates visibility impairment of approximately ten percent and could be perceived by most individuals. Table 3-4 provides EPA estimates of expected natural visibility if no human-caused impairment occurred. Values for years 2001-2004 would be the 4 year average of the best (cleanest) and worst (dirtiest) 20 percent days. The 20 percent best days are essentially the top 20 percent cleanest days (approximately 0.2 * 365 = 73 days), and likewise the 20 percent worst days are the bottom 20 percent cleanest (or dirtiest) days (approximately 0.2 * 365 = 73 days). The values measured for the 20 percent best visibility days indicate that actual (i.e., measured) visibility is slightly better than EPA's expected natural (i.e., estimated) visibility.

Table 3-4. Natural and Existing Visibility at WHRI1 Monitoring Station, 2001–2004

	20 Percent Best Days		20 Percent Worst Days	
	Natural (estimated)	Existing (measured)	Natural (estimated)	Existing (measured)
Visibility Impairment (deciview)	0.52	0.70	6.54	9.6
Visual Range (miles)	231	227	120	93
Visual Range (kilometers)	371	365	193	150

SOURCE: CDPHE APCD 2006b.

Several national parks, wilderness areas, and national monuments exist in the region. The BLM supports ambient air quality monitoring programs in Colorado for criteria pollutants, visibility, and air quality-related values in Class I pristine areas. Table 3-5 presents a list of Class I and Sensitive Class II areas within 100 miles of the WRFO Planning Area.

Table 3-5. Federal Class I and Sensitive Class II Areas

Area Name	Distance from WRFO Planning Area (miles)	Direction from WRFO Planning Area
Class I Areas		
Arches National Park	54	Southwest
Black Canyon of the Gunnison National Monument	67	South
Canyonlands National Park	77	Southwest
Eagles Nest Wilderness Area	38	East
Flat Tops Wilderness Area	On eastern boundary	East end
Maroon Bells-Snowmass Wilderness Area	33	South-Southeast
Mount Zirkel Wilderness Area	43	Northeast
Rawah Wilderness	77	Northeast
Rocky Mountain National Park	72	East
West Elk Wilderness	62	South-Southeast

Table 3-5. Federal Class I and Sensitive Class II Areas

Area Name	Distance from WRFO Planning Area (miles)	Direction from WRFO Planning Area
Sensitive Class II Areas		
Colorado National Monument	31	South
Dinosaur National Monument	On northern boundary	North end

SOURCE: URS 2007.

Atmospheric Deposition

Atmospheric deposition refers to processes in which air pollutants are removed from the atmosphere and deposited into terrestrial and aquatic ecosystems. Much of the concern about deposition is due to secondary formation of sulfur and nitrogen compounds, which could contribute to acidification of lakes, streams, and soils and affect other ecosystem characteristics, including nutrient cycling and biological diversity.

The secondary formation of pollutants occurs when primary pollutants (such as nitrogen oxides or SO_2) chemically react in the atmosphere to produce new compounds, such as nitrates or nitric acid that could have additional effects on fragile ecosystems.

Air pollutants could be deposited by either wet (precipitation) or dry (gravitational settling of particles and adherence of gaseous pollutants to soil, water, and vegetation) deposition. The BLM works cooperatively with the EPA to measure dry deposition and with private, state, and other federal organizations to measure precipitation chemistry and wet deposition.

The closest total deposition monitoring station to the WRFO Planning Area is part of the Clean Air Status and Trends Network (CASTNET) and is located east of the Continental Divide in Rocky Mountain National Park, approximately 75 miles east of the eastern tip of the WRFO administrative boundary. Table 3-6 presents total nitrogen and sulfur deposition measured at this monitoring site during 2005. Because deposition at Rocky Mountain National Park would be influenced by industrial and urban emissions along the Front Range, these values represent a conservative upper estimate of atmospheric depositions within the WRFO Planning Area, located west of the Continental Divide.

Table 3-6. 2005 Deposition at Rocky Mountain National Park

Pollutant	Deposition (kg/ha-yr)[(1)]
Total Nitrogen	2.72
Total Sulfur	1.05

SOURCE: CASTNET 2007.

NOTE:

[(1)]kg/ha-yr = kilograms per hectare per year

Hazardous Air Pollutants

Hazardous air pollutants include air pollutants that could produce serious illnesses or increased mortality, even in low concentrations. Hazardous air pollutants are compounds that have no established federal ambient standards, but they could have thresholds established by some states and are typically evaluated for potential chronic inhalation and cancer risks. The impact of HAPs on sensitive members of the population is a special concern of the BLM. Sensitive groups include

children, the elderly, and the acutely and chronically ill. Existing sources of HAPs within the WRFO Planning Area include (1) fossil fuel combustion that emits HAPs, such as formaldehyde, and (2) oil and gas operations that emit VOCs and may emit hydrogen sulfide (H_2S).

Existing Emissions in the WRFO Planning Area

Table 3-7 presents an estimate of annual emissions during 2006 from stationary point sources located within the WRFO Planning Area.

Table 3-7. 2006 Point Source Emissions in the WRFO Planning Area

Pollutant	Point Source Emissions (tons/year)
CO	1,944
NO_x	2,884
PM_{10}	1,105
SO_2	47
VOC	2,620

SOURCE: CDPHE 2007.

Management Challenges

The BLM has identified challenges for management of air quality in the WRFO Planning Area. These management challenges are based, in part, on historic activities and current conditions and trends. One challenge is that the regulation of air quality standards, emission controls and other requirements are shared by many government agencies. The BLM works cooperatively with regulatory agencies, including the CDPHE and the EPA, as well as other federal land management agencies such as the FS and the NPS.

Another challenge, prescribed burning, is a tool that has potential benefits in managing the WRFO Planning Area, but also has air quality implications that need to be considered, including possible public health and visibility impacts. In addition, energy development in the region is rapidly expanding and has potential for increasing emissions and affecting air quality.

Management actions anticipated to address the above challenges include characterizing the current status and future trends in ambient air quality in the region potentially affected by activity within the WRFO Planning Area, determining the range of air quality issues in the WRFO Planning Area, and implementing actions to maintain compliance or improve air quality. Three additional air monitoring stations in Meeker, Rangely, and Maybell have been established and data from these sites will help to inform decisions in the future. Management actions are incorporated in the alternatives and described in more detail in Chapter 2.

3.2.2 Geology

Geologic maps show the area of western Colorado underlain at the surface by sedimentary deposits of Tertiary age. These deposits are underlain by sedimentary rocks of Cretaceous to Cambrian age, which are in turn underlain by Precambrian igneous and metamorphic bedrock. The majority of the WRFO Planning Area overlaps two U.S. Geological Survey (USGS) petroleum resource assessment provinces: the Uinta-Piceance Province and the Greater Green River Province (formerly called the Ohio Creek Formation) (USGS 1995; USGS 2003). Most of the potential for oil and gas development is found in the Uinta-Piceance Province, which encompasses about 86 percent of the WRFO Planning Area.

Surface geology in the WRFO Planning Area consists mostly of sedimentary rocks ranging in age from Paleozoic to the Cenozoic. Paleozoic and Mesozoic sedimentary rocks are most common in the eastern third of the WRFO Planning Area; Mesozoic and Cenozoic sedimentary rocks dominate the northern, central, and western parts of the WRFO Planning Area. During the last half of the Cenozoic era, extrusive volcanic rocks of mostly basaltic composition intermittently covered exposed rocks along the crest of the White River Uplift. The volcanic rocks are exposed as resistant rock layers that cap older sedimentary rocks in the eastern part of the WRFO Planning Area. Cretaceous and Tertiary shales and siltstones are common in the central and western part of the area and are generally less resistant to erosion than the rocks in the White River Uplift in the eastern part of the WRFO Planning Area.

Major geologic features of the Uinta-Piceance Province include the Piceance Basin, Douglas Creek Arch, Grand Hogback, portions of the Rangely Anticline and the White River Uplift (USGS 1989). The Piceance Basin is located to the west of the Grand Hogback. The basin is a broad, southeast-northwest trending structural and topographic basin. It is bordered by the White River Dome to the east, the West Elk Mountains to the southeast and south, the Uncompaghre Uplift to the southwest, the Douglas Creek Arch to the west-northwest, the Yampa Plateau to the north, and the Axial Basin Uplift to the northeast (Dunn 1972).

The Piceance Basin encompasses 3,900 square miles of exposed Tertiary rocks. The Tertiary-Cretaceous contact is continuously exposed along the basin margin. The basin is asymmetric with gently dipping beds along the southwest flank and steeply dipping beds along the northeast flank forming the Grand Hogback. The basin axis parallels the Grand Hogback in the central part of the basin; however, the axis on the northern and southern portions of the basin is bifurcated due to basinward plunging anticlinal features (Dunn 1972). The interior portion of the northern part of the basin is characterized by a series of broad northwest trending folds in the eastern and central portions of the basin, and a series of northeast trending normal faults across the Douglas Creek Arch. Deposition of sediments into this region began with downwarping of the Piceance Basin floor during the Cretaceous era and continued through the Eocene era. Low stream gradients and moderate uplift of the marginal mountains prevented significant erosion of the basin's perimeter. This sequence of events resulted in the deposition of the Wasatch, Green River, and Uinta formations in and around a series of landlocked lakes (Bradley 1964). The surface drainage system of the basin is defined by Piceance Creek and its tributaries which drain surface exposures of the Uinta Formation in the central portion of the WRFO Planning Area (BLM 2007).

The Douglas Creek Arch and Rangely Anticline are large north trending anticlinal features that extend northward from the Uncompaghre Uplift through Rangely to the Yampa Plateau. These features separate the Piceance Basin from the Uinta Basin of Utah. The Douglas Creek Arch contains significant resources of recoverable oil and gas. Structural relief (i.e., the difference between the highest and lowest points of a stratigraphic horizon), is more than 12,000 feet in the northern portion of the Douglas Creek Arch (Kellogg 1977).

The Yampa Plateau is defined by Jurassic and older rocks at the northern end of the basin (BLM 2007). The Axial Basin Uplift is a west-northwesterly trending structural saddle that separates the Sand Wash Basin on the north from the Piceance Basin to the south. The uplift is defined by Mesozoic rock outcrops bounded on the northeast and southwest by Tertiary rocks of the Sand Wash and Piceance Basins (Dunn 1972).

3.2.2.1 Geologic Formations

The Piceance Basin contains stratified rock units ranging in age from Cambrian through middle Tertiary. This discussion of the stratigraphy describes the rock units from youngest to oldest. Stratigraphically there are approximately 28,000 feet of rock units between the highest point on the White River Uplift to the east and the Precambrian crystalline basement at the lowest depth of the basin. Table 3-8 is a generalized geologic stratigraphic column of western Colorado. Tertiary and Mesozoic formations with the potential for significant oil production and underlying formations are described in the following paragraphs.

Table 3-8. Generalized Stratigraphic Column

Geologic Time		Formation
Cenozoic	Quaternary	Alluvium, valley fill, and terrace deposits
	Tertiary	Uinta Fm Green River Fm (includes: Parachute Creek Mbr, Garden Gulch Mbr, Douglas Creek Mbr, and Anvil Points Mbr) Wasatch Fm (includes: Shire Mbr, Molina Mbr, and Atwell Gulch Mbr)
	Cretaceous	Mesaverde Gp (includes: Hunter Canyon Fm, Mount Garfield Fm, and Sego Ss) Mancos Sh Niobrara Fm Frontier Fm Mowry Sh Dakota Ss
Mesozoic	Jurassic	Morrison Fm Curtis Fm Entrada Ss Carmel Fm Navajo Ss
	Triassic	Kayenta Fm Wingate Ss Dolores Fm Chinle Fm (includes Shinarump Cgl) Moenkopi Fm
	Permian	Park City Fm/Phosphoria Fm Cutler Fm
Paleozoic	Carboniferous	Weber Ss Rico Fm Hermos Gp / Morgan Fm Molas Fm / Round Valley Ls Leadville Ls
	Devonian	Ouray Ls Elbert Fm
	Silurian	Regional Unconformity
	Ordovician	
	Cambrian	Ignacio Qtzt / Lodore Fm
Pre-Cambrian		Undifferentiated Crystalline Basement Rocks

SOURCE: Ghist 2005.

NOTES:

Cgl = Conglomerate
Fm = Formation
Gp= Group
Ls = Limestone
Mbr = Member
Qtzt = Quartzite
Sh = Shale
Ss = Sandstone

In general, a thin veneer of unconsolidated Quaternary alluvium, valley fill, and terrace deposits occupies low-lying areas. Approximately 8,000 feet of Tertiary sedimentary deposits lie below these unconsolidated sediments.

The Tertiary section consists of three major formations: the Uinta (Eocene), Green River (Eocene) and Wasatch (Paleocene-Eocene) formations. The Wasatch Formation unconformably overlies the Cretaceous Mesaverde Group throughout the basin; meaning that the younger strata that do not succeed the underlying older rocks in age or in parallel position, as a result of a long period of erosion or nondeposition.

The Uinta Formation is the surficial geologic formation throughout most of the Piceance Basin and is present below unconsolidated Quaternary sediments. The Uinta Formation consists of sandstones with interbedded sequences of siltstones and marly siltstones. Marlstone is more abundant in the lower portion of the formation. It also includes conglomerates and tuff. The Uinta Formation was formed mainly from clastic fluvial-deltaic sediments prograding southward and inter-tonguing with the lacustrine Green River Formation. The thickness of this formation varies within the WRFO Planning Area (BLM 2007b).

The Green River Formation lies below the Uinta Formation and includes beds of oil shale (Cashion 1973). The contact of the Uinta Formation with the Green River Formation is marked by an abrupt transition from gray siltstone to dark brown, moderately rich oil shale. The Green River Formation in the Piceance Basin is divided into four members: the Parachute Creek (upper member), Garden Gulch (intermediate member), Douglas Creek (lowest member), and Anvil Points (lateral correlative of the Douglas Creek and Garden Gulch Members, and part of the lower Parachute Creek Member). The Parachute Creek Member contains virtually all of the oil shale, nahcolite, and dawsonite resources in the Piceance Basin. At the top of the Parachute Creek Member, tongues of the Green River Formation are interfingered with the lower part of the Uinta Formation. The Green River Formation rests conformably on top of the Wasatch Formation (BLM 2007); meaning there is an unbroken sequence of strata or beds, characteristic of uninterrupted deposition.

The Wasatch Formation could reach a maximum thickness of 5,500 feet, making this stratigraphic sequence the thickest Tertiary unit in the Piceance Basin. In the southern and eastern portion of the basin, the Wasatch Formation has been subdivided from top to bottom into the Shire, Molina, and Atwell Gulch members. The Shire Member has variegated siltstone, claystone, and sandstones. The Molina Member is dominated by massive, cross-stratified sandstone. The basal Atwell Gulch Member is composed of variegated siltstone and claystone (Donnell 1961). The Wasatch Formation is undivided in the northern part of the basin.

Rocks of Cretaceous age are extensive in the area and cover more than 31,000 square miles. Thicknesses range from 6,000 to 10,000 feet. The Cretaceous section is characterized by complex interfingering of marine and continental strata. The environments of deposition were mainly marine in the eastern part of the basin and mainly continental in the western part. Nine principal marine transgressions and regressions have been recognized. The seas were mostly transgressive in the early Cretaceous and early parts of the Late Cretaceous, and then mostly regressive throughout the remaining portion of the Late Cretaceous (Kellogg 1977). From oldest to youngest, Cretaceous rocks consist of the Dakota Sandstone, Mowry Shale, Frontier Formation, Niobrara Formation (limestone and calcareous shale), Mancos Shale, and Mesaverde Group. The Mesaverde Group, in descending order, consists of: Hunter Canyon Formation, Mount Garfield Formation (Rollins Member, Cozzette Member, and Corcoran Member), and Sego Sandstone (Johnson 1979). The Hunter Canyon Formation and the upper part of the Mount Garfield Formation consist of fluvial

channel-form sandstone that is locally conglomeratic and interbedded with siltstone, claystone, and carbonaceous shale. The Hunter Canyon Formation grades into the Williams Fork Formation in the northern part of the basin. The members of the Mount Garfield Formation consist of laterally extensive marine sandstone interbedded with paludal organic-rich shale, carbonaceous claystone, and coal. The Cozzette Member also contains marine shale. The Sego Sandstone consists of laterally extensive marine sandstone.

Jurassic and Triassic rocks are composed of interbedded marine and continental strata. Total thicknesses range from 500 to 6,000 feet. Three marine cycles of deposition are represented in this section. The cycles consist of red and varicolored continental shale and red, orange, and white fluvial and eolian sandstone. The Shinarump, Navajo, and Entrada sedimentary rocks include regionally well-developed porous sandstones that provide reservoirs for several producing oil and gas fields, including Wilson Creek (Kellogg 1977).

Pennsylvanian and Permian rock thicknesses range from zero to more than 10,000 feet. Sediments were deposited during a period of great tectonic activity. Large quantities of clastic sediment were eroded and a large amount of sand was transported into the area during the uplift of the ancestral Rockies. The rock units consist predominantly of sandstone and arkose with interbedded carbonate rocks present in northwestern Colorado. At least three, and possibly four, major unconformities have been recognized within these sequences.

In northwestern Colorado, lower Pennsylvanian rocks contain interbedded dark gray organic shale and limestone, above which are evaporite rocks that were deposited in a basin that developed locally. Two types of sandstone are prevalent in this sedimentary sequence: mature quartzose sandstone and arkose. The arkose lies in thick wedges adjacent to Precambrian granite uplifts. The ancestral Rockies were the source for these arkosic sediments. The uppermost of the quartzose sandstone is the Weber Sandstone of Pennsylvanian and Permian age. Overlying the Weber Sandstone is the Upper Permian Park City or Phosphoria Formation, a marine cyclic deposit rich in hydrocarbons (Kellogg 1977).

The Devonian rock of northwestern Colorado is composed of dolomite and quartzitic sandstone. Devonian and Mississippian age rocks range in thickness from zero to more than 3,000 feet with predominantly carbonate rocks (dolomite) and an upper dark shale sequence. Some sandstone is present at the base and also overlies the carbonate rocks. The sandstone is usually cemented by calcite and has limited porosity (Kellogg 1977).

Precambrian crystalline basement rock is estimated to be 24,000 feet below ground surface in the central portion of the northern Piceance Basin (Murray and Haun 1974). Precambrian rocks are exposed in the White River Plateau and include metamorphic rocks (gneiss and schist) ranging in age from 1,700 million years old (MY) to 1,800 MY. Precambrian granitic rocks approximately 1,700 MY are also present in the White River Plateau.

3.2.2.2 Geologic Hazards

The WRFO Planning Area lies within Seismic Risk Zone 1 (on a scale of 0 to 3, with Zone 3 having the highest risk) (Algermissen 1969). Within Zone 1, minor damage to structures from distant earthquakes could be expected. The National Earthquake Information Center database (USGS 2006a) was searched in the area within approximately 100 miles of the WRFO Planning Area. Since 1950, the largest seismic event within the search area was magnitude 5.7 (Modified Mercalli Intensity VII) and was centered at approximately 39º 47'N, 108º 22'W, which is 6 miles south of the southern border of the WRFO boundary.

Unstable slopes occur on hillsides or cliffs, or in areas that are susceptible to landslides, mudflows, rock falls, or accelerated creep of slope-forming materials. Unstable slopes occur naturally and are widespread in the WRFO Planning Area. Most unstable slopes consist of weathered sedimentary strata and/or recent colluvium deposits that move downhill due to gravity. Unstable slopes could be active or inactive. Slope failure could be initiated by a change of conditions, either natural or man-induced. Natural factors contributing to slope instability include weathering and erosion, changes in the hydrologic characteristics of the hillside, loss of vegetation cover, earthquakes, and the slow natural deterioration of slope strength. Artificial factors that could undermine slope strength are cut and fill operations, alteration of surface drainages, excessive irrigation, removal of vegetation cover, blasting, and vehicular traffic.

3.2.3 Soil Resources

Several resources and resource uses, such as livestock grazing, wildlife habitats, and recreation, depend on the suitability and qualities of soils. Thus, the preservation of soils and the productivity of public land are a high priority in BLM land management decisions.

The USDA has mapped soil resources in most of the WRFO Planning Area. The soil resources in most of Rio Blanco County were previously mapped by the USDA SCS (USDA 1982) and more recently by the USDA NRCS (USDA 2008a). Soil resources in much of Garfield County were also mapped by the SCS (USDA 1985; 2003) and NRCS (USDA 2008b; 2008c). More recently, the soils in most of Moffat County were mapped by the NRCS (USDA 2008d). The NRCS also completed a separate soil survey for Dinosaur National Monument (USDA 2008e). Soil data are not available for FS lands in the eastern portion of Rio Blanco County.

Soils are the product of the climate, the underlying bedrock lithology, and the topography. Many of the soils in the WRFO Planning Area are derived from lithologies such as the sandstones, siltstones, and marlstones associated with the Uinta Formation and the Green River Formation; and the claystones, shale, and sandstones associated with the lower part of the Green River Formation, the Mesaverde Group, the Wasatch Formation, the Fort Union Formation, and the Mancos Shale. Soils derived from Mancos Shale or from other saline sedimentary formations tend to be high in salts and trace elements like selenium. Due to the salt content in these soils, vegetative cover is sparse, resulting in soil particles not being "anchored" in place; thus, the soil is easily eroded by wind and water. These sparsely vegetated sedimentary basins with poor soil, known as shale deserts, occur in the northern portion of the WRFO Planning Area. These areas are characterized as nearly level basins and valleys, benches, and low rounded hills containing shallow clayey and silty soils (BLM 2007).

The mapped soil associations in each soil survey are most closely correlated to the various landforms and surface geology of the WRFO Planning Area. Management actions are incorporated in the alternatives and described in more detail in Chapter 2 for soils. The following descriptions for each county are primarily developed from the NRCS soil surveys. Map 1-1 shows counties in the Planning Area in relation to the WRFO boundary.

Rio Blanco County

Soil types in the portion of the WRFO Planning Area that occurs in Rio Blanco County are as diverse as the underlying parental material. In the westernmost quarter of the county, along much of the northern county boundary, and along the Grand Hogback that bisects the county from north to south, the most prevalent soil associations include the Rentsac-Moyerson-Rock Outcrop complex. This is a shallow, well-drained group of loam soils formed on the Mesaverde Group sandstones and

shales. The Rentsac soil type is a grayish brown channery loam formed in residuum derived primarily from sandstone. It is the most widespread soil type by acreage in the county. The Moyerson soil is a light gray clay loam formed in residuum derived primarily from shale. This complex has a moderate to very high erosion hazard due to slope erodibility.

The Irigul-Parachute complex and its component soils are common in the much of the west-central half of Rio Blanco County, as is the Castner channery loam. The Irigul soil is a grayish brown channery loam and is shallow and well drained. The Parachute soil is a grayish brown loam and is moderately deep and well drained. These soils are formed on the sandstone, siltstone, shale and claystone of the Uinta, Wasatch, and Green River Formations. This complex is common on ridges and mountainsides and has a moderate to very high erosion hazard due to slope erodibility. The Castner channery loam consists of shallow, well-drained soil with moderate permeability that is mainly suitable for rangeland. It has a moderate erosion hazard due to slope erodibility.

Much of the southeastern portion of Rio Blanco County contains a diversity of soil types. The most common soils include the Tampico-Miracle complex. The Tampico soil consists of brown, deep, well-drained loam that is moderately permeable and forms on mountain slopes. This soil has a moderate to high erosion hazard due to slope erodibility. The Miracle soil is a brown, moderately deep, well-drained fine sandy loam that formed in material weathered from sandstone. Miracle soils are on upland hills and plateaus and have a slight erosion hazard. The overall erosion potential for the Tampico-Miracle complex is moderate to very high. These soils are derived from Paleozoic sandstone, shale and limestone, as well as younger volcanic and granitic parent material.

The Winnemucca-Clayburn loams are also common in southeastern Rio Blanco County. The Winnemucca soil is dark gray brown and consists of very deep, well-drained loam and has a slow permeability. The Winnemucca soils formed in alluvium and colluvium derived from intermediate volcanic materials. The Clayburn loam is very dark gray brown, very deep, well drained soil that formed in glacial drift, colluvium, or alluvium derived mainly from shale, sandstone, and andesite. This complex has a moderate to high erosion hazard due to slope erodibility.

Throughout Rio Blanco County, the Torriorthents-Rock Outcrop complex is found on steep slopes. This soil complex is well drained and varies from loamy to clayey with variable amounts of gravel and stones. This complex has a severe erosion hazard due to slope erodibility. Although they do not comprise a large percentage of the WRFO Planning Area, the Razorba channery loam and the Rhone loam are two soils that warrant concern because they are common on steep slopes. These soils have a very severe erosion hazard due to slope erodibility.

Moffat County

Soil types in the WRFO Planning Area within southwestern Moffat County are generally comparable to those in northwestern Rio Blanco County. A portion of the WRFO Planning Area south of the Yampa River is within Dinosaur National Monument, which has its own soil survey containing different mapped soil units.

The eastern area of Moffat County within the WRFO Planning Area and east of Strawberry Creek contains extensive acreage of the Rentsac-Moyerson-Rock Outcrop complex. This is a shallow, well-drained group of loam soils formed on the Mesaverde Group sandstones and shales. The Rentsac soil type is a grayish brown channery loam formed in residuum derived primarily from sandstone. It is the most widespread and abundant soil type by acreage in the county. The Moyerson soil is a light gray clay loam formed in residuum derived primarily from shale. This association supports a pinyon/juniper woodland community on moderate clayey slopes. This complex has a

moderate erosion hazard due to slope erodibility. A very common soil downslope from the Rentsac-Moyerson-Rock Outcrop complex is the Torriorthents-Rock Outcrop complex. This soil complex forms on steep slopes, is well drained and varies from loamy to clayey textures with variable amounts of gravel and stones. This complex has a severe erosion hazard due to slope erodibility. This part of the WRFO Planning Area also contains the Jerry-Thornburg-Rhone complex, which is described below.

The eastern area of Moffat County within the WRFO Planning Area and west of Strawberry Creek contains the Jerry-Thornburg-Rhone complex and Veatch soils. The Jerry soil is a dark gray loam. It is a deep to very deep and well-drained soil formed from residuum of sandstone and shale. It has rapid runoff and low permeability. The Thornburg loam soil is brown, deep and very well drained, with rapid runoff and moderate permeability. Rhone loam soils are formed on the sandstone, siltstone, shale and claystone of the Uinta, Wasatch, and Green River Formations. The Rhone soil is common on ridges and mountainsides and has a moderate erosion hazard due to slope erodibility. The Veatch soil is dark brown channery loam formed from colluvium and alluvium. It is moderately deep and well drained with moderate permeability.

The most common soils in the western part of Moffat County, both within and south of Dinosaur National Monument, are Rock Outcrops, Ustorthents soils, and the previously described Torriorthents-Rock Outcrop complex. These soil types indicate the relative scarcity of developed soil profiles and stabilizing vegetative cover on steep slopes in desert terrain.

The Cragnot-Pensore-Grapit Association is also present in the western part of the WRFO Planning Area. The Cragnot soil is dark brown channery loam. It is a very deep, well-drained soil with moderate runoff and low to moderate permeability. The Pensore soil is a gray brown gravelly loam that is shallow and well drained. The Grapit soil is a very deep and well-drained brown gravelly loam with low to high runoff and moderate permeability. The Cragnot-Pensore-Grapit Association is a stony soil complex with moderate erosion hazard due to slope erodibility.

Garfield County

Soil types in the WRFO Planning Area within northern Garfield County are generally comparable to those described for southern Rio Blanco County. In the northwest part of Garfield County (Douglas Plateau area) in the WRFO Planning Area, the Parachute-Irigul complex is common. The Parachute soil is a grayish brown loam and is moderately deep and well drained. The Irigul soil is a grayish brown channery loam and is shallow and well drained. These soils are formed on the sandstone, siltstone, shale and claystone of the Green River and Wasatch Formations. This complex is common on ridges and mountainsides and has a moderate to very high erosion hazard due to slope erodibility. The common soil downslope from the Parachute-Irigul complex is the Torriorthents-Rock Outcrop complex.

The Wrayha-Veatch-Rabbitex and Wrayha-Rabbitex-Veatch complexes are also common on slopes in the northwestern part of the WRFO Planning Area in Garfield County, and could be comparable to the Rentsac-Moyerson complex in Rio Blanco County. The Wrayha soil is brown stony clay loam that is deep and well drained with slow permeability. It is formed from residuum derived from shale. The Veatch soil is dark brown channery loam formed from colluvium and alluvium. It is moderately deep and well drained with moderate permeability. The Rabbitex soil is a brown loam formed from colluvium weathered from limestone. It is a deep to very deep well drained soil. The hazard of water erosion is very severe in this complex.

The Caballo is a dark gray brown, deep, and well-drained soil that formed in material weathered from residuum of limestone, siltstone and limy soft shale derived from the Green River Formation. Caballo soils are on mountain sideslopes. The soil has a rapid runoff potential and a very severe erosion hazard due to slope erodibility.

In the central part of northern Garfield County, the Parachute-Irigul and Northwater-Adel complexes are formed from residuum derived from the sandstones and siltstones of the Uinta Formation. The Northwater-Adel complex is found on mountainsides and footslopes of 5 to 50 percent. The Northwater soil consists of deep, grayish brown loam with rapid runoff and moderate drainage. The Adel soil is a deep and well-drained dark gray clay loam. It has moderate permeability and medium runoff. The water erosion hazard for this complex is moderate to very severe.

In northern Garfield County east of the Grand Hogback, common soils include the Lamphier-Miracle complex. The Lamphier soil is a brown loam that is very deep and well drained, with moderate runoff and moderate permeability. This complex has a slight to moderate erosion hazard. The Miracle soil is a brown, moderately deep, well-drained fine sandy loam that formed in material weathered from sandstone. Miracle soils are on upland hills and plateaus and have a slight erosion hazard. The overall erosion potential for the Lamphier-Miracle complex is moderate to very high. These soils are derived from Paleozoic sandstone, shale and limestone, as well as younger volcanic and granitic parent material.

Sensitive and Fragile Soils

Soils identified as sensitive or fragile in the Planning Area are typically located on steep slopes (greater than 35 percent) and also have one of the following characteristics:

- A surface texture of sand, loamy sand, very fine sandy loam, fine sandy loam, silty clay, or clay
- A depth to bedrock that is less than 20 inches
- An erosion condition rated as poor
- A soil erodibility factor (K factor) that exceeds 0.32

Activities proposed on fragile soils would be subject to surface use stipulations that would mitigate surface erosion and subsequent watershed problems. Areas designated for CSU stipulations include fragile soils on slopes greater than 35 percent and saline soils derived from Mancos Shale. These soil classes are managed as CSU-1 areas according to the 1997 White River RMP. Surface disturbing activities in CSU-1 areas require an engineered construction/reclamation plan that addresses restoration of soil productivity and soil erosion. These soils may also be high in trace elements such as selenium. A summary of the percentage of soils in each county within the WRFO Planning Area that have a severe or very severe erosion hazard are presented below:

- Garfield County: CSU-1 (9.0 percent)
- Moffat County: CSU-1 (7.6 percent)
- Rio Blanco County: CSU-1 (21.1 percent)

Areas designated for NSO stipulation, more specifically NSO-1 Landslide Areas, designate areas where soils are considered unstable and subject to slumping and mass movement. Surface

disturbance is generally not allowed in NSO-1 areas unless exceptions or modifications are granted by the Authorized Officer.

In addition to fragile soils, fragile watersheds were identified in the 1997 White River RMP. These watersheds were identified as having soils that could need additional protection and treatment to meet the Standards for Public Land Health. Site specific COAs are applied in these areas to meet resource objectives. During comprehensive watershed planning, protection methods may be identified to help watersheds which are contributing accelerated erosion, trace elements and salt contributions to the Colorado River System.

Biological Soil Crusts

Biological soil crusts (BSC), also known as cryptogamic soils, are more likely to occur in locations that have not experienced significant livestock grazing or other disturbance. Biological soil crusts are an important component of soil productivity that result from associations between soil particles and cyanobacteria, algae, microfungi, lichens, and bryophytes living within or on top of the uppermost soil horizons (Belnap et al. 2001). Biological soil crusts retain soil moisture and contribute nutrients in soils. Soil crusts are also an indicator and contributor to rangeland health (Pellant et al. 2000). Depending on the site, BSC can be a significant factor in stabilizing soils and reducing erosion, and they often play a decisive role in the success of vegetation and retention and/or production of soil nutrients.

Biological soil crusts are known to occur on public lands near and within the WRFO Planning Area (BLM 2004a). They are typically more abundant in some locations due to microclimate conditions and plant communities that modify the local environment by providing nutrients, moisture, reducing sunlight, and protecting BSC from erosion. Spatial inventories of BSC on public lands have not been performed in the WRFO Planning Area. Thus, it is not possible at this time to assess the current state of these resources.

The BLM recognizes the ecological value of fragile BSC and typically implements site specific COAs, when possible, to preserve them. Disturbance of BSC may require considerable time to revegetate, up to 56 years from one study (Kade and Warren 2002). Vehicle tires are particularly destructive to soil crusts (Belnap et al. 2001; Kade and Warren 2002), but if the vehicle tracks are isolated and infrequent soil crusts may recolonize the area more quickly than a constructed road.

Important Farmlands

Four categories of farmlands are federally regulated by the USDA under the Farmland Protection Policy Act: (1) prime farmlands; (2) unique farmlands; (3) farmlands of statewide importance; and (4) farmlands of local importance. Important farmlands are a distinction made by the USDA for soils that support the crops necessary for the preservation of the nation's domestic food and other supplies, specifically the capacity to preserve high yields of food, seed, forage, fiber, and oilseed with minimal agricultural amendment of the soil, adequate water, and a sufficient growing season. Several USDA and other federal natural resource programs, permits, and regulations require the identification of important farmlands.

No important farmlands occur on BLM administered lands. Important farmlands do occur in the WRFO Planning Area on private lands that could have BLM administered mineral resources. These areas (private surface but public minerals) are very rare and typically small portions of irrigated pastures along the White River and Piceance Creek. These important farmlands would be protected when possible through site specific COAs.

Erosion

Surface disturbance to build well pads, install pipelines, roads and other infrastructure is likely to contribute to erosion. Disturbed soils during oil and gas development are nonpoint sources of sedimentation and runoff. Surface disturbance through the process of erosion can introduce sediments, salts, selenium and other trace element into surface water from disturbed soils. The BLM has used an erosion model to better understand how management under each alternative would impact hillside erosion rates in the planning area. Specifically, the Disturbed WEPP (Water Erosion Prediction Project) model is used to calculate erosion rates which are based on parameters that estimate conditions in the planning area (Elliot and Hall 2010). This method was implemented in the Bighorn Basin Draft RMP (BLM 2012), to calculate a general erosion rate that could be multiplied by the acres of disturbance expected under each alternative. This analysis will use disturbance acreage estimated at the end of the 20 year planning period to compare annual mean erosion rates by alternative in tons/year.

The Draft RMP for Bighorn Basin calculated one erosion rate for short-term disturbance to simulate no reclamation and one rate for long-term disturbance to simulate successful reclamation. The Bighorn Basin Draft EIS used erosion rates based on WEPP input parameters selected to mimic conditions that may be expected with soil disturbance. Model runs used with older versions of the WEPP model may be expected estimate different erosion rates. Model runs for this analysis were done using version Model 2.0-beta, available on the internet at http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/wd/weppdist.pl and accessed on May 23, 2012.

Accelerated erosion is a term that is used to define erosion above background conditions. It was assumed for the Bighorn Basin Draft RMP, that undisturbed areas had no change in the erosion rate due to surface disturbance. This is not to say that natural erosion does not occur in undisturbed areas, that erosion rates do not change in time, nor that undisturbed areas may not be affected by surface disturbance for oil and gas, just that it is beyond the scope of this analysis. This analysis is designed to estimate accelerated erosion or the erosion above background conditions for comparison across alternatives. The erosion rates also do not consider oil and gas operator's efforts to control stormwater onto and off construction sites. Stormwater BMPs are designed to contain sediment and reduce erosion from surface disturbance on construction sites and these stormwaters measures are assumed to be equally effective under all alternatives. Therefore, actual erosion rates may be very different in practice from estimates. It is important to know that estimates are only calculated to allow for a quantitative comparison of erosion rates by alternative.

Susceptibility to erosion is a function of slope, soil surface texture, vegetation cover and soil cohesion within and between soil layers. Often erosion is driven by chemical changes in soil layers or subsurface hydrology; this can often lead to piping and/or mass movement that will be location specific and can be catastrophic. This type of mass movement of soils is more likely when there is a water-dissolvable soil layer overlain by a soil with changing infiltration characteristics or in area of high and preferential groundwater flow. This is common in many of the fragile watersheds identified in Map 3-3, but can occur locally in most areas of the MPA. The application of the WEPP model in this analysis does not consider any of these site specific factors that may impact erosion, nor does it anticipate the potential for transportation of sediment to surface waters.

Using the United States Forest Service (USFS) web-based Disturbed WEPP erosion model (Elliot and Hall 2010) long-term and short-term erosion rates were calculated for the MPA by selecting local parameters when possible and according to the methodology developed for the Bighorn Basin Draft EIS (BLM 2012). The following assumptions and parameters were selected in the Disturbed

WEPP Model to estimate short-term (un-reclaimed) and long-term (successful reclamation) in the MPA:

- Years to simulate: 50 years
- Climate: Maybell, Colorado
- Soil Texture: Sandy Loam
- Treatment/Vegetation: high severity fire with zero percent cover to model short-term disturbance and short-grass prairie with 40 percent cover for long-term disturbance for the upper and lower elements.
- Gradient: Upper slope of 35-50 percent and lower slopes of 0-35 percent with a slope length of 300 feet for both, which is the standard length used in environmental planning (BLM 2012).
- Rock Cover: 20 percent due to the predominance of channery loam soil types.

Results of the model run using these parameters were 0.08 tons/acre for un-reclaimed areas and 0.02 tons/acre for reclaimed areas. This was based on 50 years of climate data that calculated storms for the 50, 25, 10, 5 and 2.5 year storms. The average or mean erosion over the simulated 50 years was used. The model also estimates the amount of sediment that would leave the profile modeled, which was roughly 1/5 the rate calculated for both simulations.

3.2.4 Water Resources

This section characterizes surface water and groundwater resources and describes water use and current water management practices within the WRFO Planning Area. Management actions for this amendment are incorporated in the alternatives and described in more detail in Chapter 2.

The primary regulatory framework for water resources is the Clean Water Act (CWA). The 1987 CWA as amended (33 USC 1251) established objectives to restore and maintain the chemical, physical, and biological integrity of the nation's water. The act also requires permits for point source discharges to navigable Waters of the U.S., provisions for the protection of wetlands, and monitoring and research provisions for protection of ambient water quality. The Safe Drinking Water Act (SDWA) is the federal law that ensures the quality of Americans' drinking water. The SDWA was originally passed by Congress in 1974 and amended in 1986 and 1996 to require actions to protect rivers, lakes, reservoirs, springs, and groundwater wells used as public water supplies. In February 1998, the President issued the "Clean Water Action Plan: Restoring and Protecting America's Waters". The Clean Water Action Plan calls for federal agencies to engage in watershed management as a core guiding principle for water quality management.

Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of flood plain development wherever there is a practicable alternative. Each agency is directed to take action to preserve the natural and beneficial values including but not limited to water related land resources planning, regulation and licensing activities.

The BLM contributes to the protection of water quality by instituting BMPs such as well completion practices, site location, design features for roads and pads, measures for the prevention, containment and remediation of spills and leaks on public lands among other measures (See Appendix B, Best

Management Practices and Resource Protection Measures, and Appendix H, Oil and Gas Operations in the White River Field Office).

Public water supplies in the WRFO Planning area include municipal systems for Meeker, Rangely, and smaller communities such as Dinosaur and Massadona. Domestic and household private drinking water sources for ranch houses are typically wells or springs on private land and may include BLM administered land and/or oil and gas leases in the contributing areas for these wells. Meeker's municipal water supply comes from groundwater wells completed in the White River alluvium in an area of low-potential for oil and gas development on private land up river from town. This area was identified in the Meeker Sourcewater Protection Plan completed in 2010 as the primary protection zone for Meeker. Rangely's water supply is from an inlet along the White River between town and the Taylor Draw Dam and Kenny Reservoir. Historical and current oil and gas development has and is occurring around the town of Rangely. Both towns have gone through source water protection planning processes and are currently in the implementation phase. Dinosaur, Dinosaur National Monument Headquarters, and Massadona are served by groundwater wells.

Colorado Oil and Gas Conservation Commission (COGCC) Rule 317B is designed to protect surface water supply areas. It became effective on federal lands in April of 2009 and is applicable to drilling, completion, production, and storage operations for oil and gas development. The COGCC buffers in the 317B rule that occur in the WRFO Planning Area are a 300 feet internal buffer (1,900 acres), a 500 feet intermediate buffer (3,100 acres), and a ½ mile external buffer (12,300 acres). These buffers were established to protect the surface water intake for the town of Rangely. Drilling, completion, production and storage activities cannot occur on the surface within the internal buffer. Pitless drilling systems using tanks is required in the intermediate buffer, as well as water quality testing before and after drilling, notification of the public water supplier and an emergency response program. The external buffer requires similar measures to the intermediate buffer. The public water supplies in the rest of the WRFO Planning Area are groundwater supplies and are not affected by the 317B rule. BLM would expect all oil and gas operators to abide by COGCC rules for public water supplies and other rules on Federal lands and to develop Federal minerals (COGCC 1991).

It is expected that 95 percent of the proposed new wells considered in this amendment would be drilled into the MPA (BLM 2007). The MPA within the WRFO Planning Area roughly corresponds to the Piceance and Yellow Creek watershed boundaries. Ninety-five percent of new drilling activity is expected to occur in these two watersheds. Oil and gas drilling activity occurred in the rest of the WRFO Planning Area during and prior to the 1997 White River RMP and is currently in various stages of production. There is a significant amount of field maintenance in these older development areas that would continue throughout the analysis period. Some exploration and development is still anticipated outside of the MPA. Several of the watersheds identified in the 1997 White River RMP as fragile, coincide with past oil and gas development, and could experience limited development in the future (e.g., Red Wash, Stinking Water, Cottonwood Creek, Evacuation Creek, and Douglas Creek). The 2007 RFD scenario assumes areas outside the MPA would be exploratory or conventional development with single well pads as opposed to the multi-well pads more common throughout the MPA.

Rugged topography is characteristic of much of the WRFO-managed lands, causing large variations in precipitation and climate within short distances (WRCC 2008a). Annual precipitation ranges from over 40 inches at the headwaters of the White River to less than 10 inches near the Utah border (National Atlas 2005; WRCC 1997). About half of the precipitation falls as snowfall and typically persists through the winter only at higher elevations (USGS 1987). Annual evaporation data for this

portion of northwestern Colorado is not available; however, the WRCC records evaporation at two sites near Grand Junction in the Colorado River valley, which has a similar (albeit slightly drier) climate to the WRFO Planning Area. From 1962 to 2005, average evaporation near Grand Junction was approximately 64 inches per year (WRCC 2008b). Climate conditions for the WRFO Planning Area are further described in Section 3.2.1.1.

3.2.4.1 Surface Water

The lands managed by the WRFO are located within four basins of the Colorado River Region (Yampa, Green, White, and Upper Colorado River basins). This region has been divided into nine sub-basins (Table 3-9). The majority of the WRFO Planning Area (88 percent) is within the White River Basin. The White River, formed by forested headwater creeks in the eastern portion of the WRFO Planning Area, flows to the west and is joined by Piceance Creek, Yellow Creek, Douglas Creek, and other minor tributaries as it approaches the Colorado-Utah state line. Beyond the WRFO Planning Area, the White River joins the Green River and eventually the Colorado River. Natural flows in the White River are modified by Taylor Draw Dam which forms Kenny Reservoir on the mainstem of the White River near Rangely, as well as Lake Avery, an on channel reservoir along Big Beaver Creek, which is tributary to the White River and joins the main channel just downstream of the North and South Forks of the White River confluence. In addition, flow in the river is affected by diversions for the irrigation of hay meadows located along stream channels; by off-channel reservoirs such as Rio Blanco Lake; and by a number of small, in-channel reservoirs built in tributaries for sediment retention or livestock watering (see Map 3-1).

A small segment of the WRFO Planning Area extends south to encompass portions of the Roan Plateau in Garfield County. This part of the WRFO Planning Area is drained by Parachute and Roan Creeks, which flow south into the Colorado River. The northwestern portion of the WRFO Planning Area, located in Moffat County, contains the upper portions of several small watersheds that flow north into the Yampa River and Green River basins. Table 3-9 identifies the major sub-basins and their acreage within the WRFO Planning Area.

Table 3-9. Major Sub-Basins within the WRFO Planning Area

Major Subbasins	Hydrologic Unit Code (HUC)	Acres in the WRFO Planning Area	Acres on BLM Land
White River		**2,338,600**	**1,364,400**
Upper White River	14050005	824,500	186,700
Piceance-Yellow	14050006	582,800	412,900
Lower White River	14050007	931,400	764,800
Yampa River		**192,500**	**43,200**
Upper Yampa	14050001	10,600	0
Lower Yampa	14050002	181,900	43,200
Green River		**38,200**	**21,600**
Lower Green-Diamond	14060001	38,200	21,600
Colorado River		**93,800**	**18,800**
Colorado headwaters	14010001	200	0
Colorado headwaters-Plateau	14010005	19,000	9,700
Parachute-Roan	14010006	85,100	16,900
TOTAL WATERSHEDS		**2,673,700**	**1,455,800**

SOURCE: BLM GIS Data; Sept. 12, 2011.

The MPA (Map 3-1) is contained mostly within the Piceance-Yellow Creek sub-basin (Hydrologic Unit Code [HUC] 14050006), which is tributary to the Upper and Lower White River (HUC 14050005 and 14050007). Small portions of the MPA are also located in the Upper Colorado and in the Douglas Creek drainage of the Lower White River sub-basin. The primary drainages in the Mesaverde Play Area include mainstream Piceance, Dry Fork Piceance, Black Sulphur, Hunter, Willow, Cow, and Yellow creeks.

The BLM has ongoing water resource monitoring efforts for Piceance Creek, Yellow Creek, and the White River in the MPA. These efforts include supporting USGS stream flow sites by funding water quality sampling, collecting macorinvertrabrate samples, and supporting automated data collection of water quality parameters. Electrical conductivity probes have recently been installed at two locations on Piceance Creek and one location on Yellow Creek to supplement ongoing data collection. The BLM is also supporting groundwater monitoring efforts in conjunction with the USGS to evaluate water quality and availability for regional aquifers. Additional hydrologic data, including precipitation, stream flow, and water quality, are collected by BLM from public lands throughout the WRFO.

Water Quantity

The major perennial streams within the WRFO Planning Area are shown on Map 3-1. Snowmelt in spring and early summer provides the major source of runoff for perennial streams, with groundwater inflow along gaining stream segments being a contributor during the remainder of the year. During dry periods, most of the annual stream flow in the WRFO Planning Area is derived from groundwater discharging into streams (baseflow).

Perennial streams receiving significant flow from lands administered by BLM include Piceance Creek, Yellow Creek, and Douglas Creek. Major tributaries to Piceance Creek include Cow Creek, Stewart Gulch, Willow Creek, Hunter Creek, Black Sulphur Creek, Ryan Gulch, and Dry Fork Piceance Creek. Many of the perennial streams and their major tributaries include diversions for irrigation of hay meadows adjacent to the channel. There is also surface water use for oil and gas activities including drilling, domestic use, construction, dust abatement, well completion actives, and hydrostatic testing of pipelines.

Ephemeral streams in the WRFO Planning Area generally have their headwaters at lower elevations (i.e., below 8,000 feet) and are tributary to perennial systems such as the White River, Piceance Creek, Yellow Creek, and Douglas Creek. Ephemeral streams only flow during spring runoff and after intense storms. Frequently these ephemeral drainages occur as steep and relatively straight channels that are actively incising across upper reaches, and that deposit sediments throughout the lower reaches as gradients flatten. Peak flows in these streams occur during spring snowmelt (March through May) and after intense summer and fall thunderstorms. Many of these systems are found in the Yellow Creek watershed, the Douglas Creek watershed, and around tributaries to the Lower White River such as Red Wash and Wolf Creek.

Interrupted and intermittent streams in the Piceance Creek watershed are common. Hunter Creek, Ryan Gulch, Fawn Creek and others have significant flows in the alluvial aquifer with only limited surface expression. Although these watersheds are large with high water yields, surface expression of the creeks is limited to areas with high stormwater runoff or where permeability of the alluvium is reduced and water is forced to the surface.

Historic stream flow data are available from the USGS for several streamflow monitoring stations on the White River and other drainages that flow into the White River. Table 3-10 lists data from

several of these streamflow monitoring stations arranged in an upstream to downstream order. Figure 3-3 and Figure 3-4 show the 2006 daily mean discharges and historical statistics for streamflow stations on Piceance Creek and the White River, respectively. The majority of the flow originates in the eastern portion of the WRFO Planning Area (North Fork and South Fork of the White River) where topographic elevations and precipitation amounts are highest. Tributary streams entering the White River in the western portion of the WRFO Planning Area (e.g., Piceance, Yellow, and Douglas creeks) have lower flow rates. Both the low-flow and high-flow calculated annual rates show significant but consistent departure from the average or mean flow rate.

Table 3-10. Select USGS Sites and Annual Stream Flows

Streamflow Monitoring Location[1]	Years Recorded	Average, cfs[2]	Low, cfs (year)	High, cfs (year)
North Fork White River near Buford (09303000)	1910-2001	316	157 (1977)	523 (1984)
South Fork White River near Buford (09304000)	1919-1997	256	129 (1977)	362 (1985)
White River below North Elk Creek near Buford (09304115)	2003-2009	568	459 (2004)	677 (2005)
White River near Meeker (09304500)	1910-2010	619	274 (1977)	1,004 (1984)
Piceance Creek below Rio Blanco (09306007)	1974-1998	21	5.0 (1977)	55 (1984)
Stewart Gulch above West Fork (09306022)	1975-1985	2.0	1.0 (1979)	7.0 (1985)
Willow Creek near Rio Blanco (09306058)	1974-1985	3.0	1.0 (1978)	9 (1985)
Piceance Creek below Ryan Gulch (09306200)	1965-2010	28	6.4 (2003)	96 (1985)
Piceance Creek at White River (09306222)	1965-2010	34	6.0 (2003)	110(1985)
Corral Gulch near Rangely (09306242)	1974-2010	1.7	0.2(2006)	7.8 (1984)
Yellow Creek near White River (09306255)	1973-2010	2.7	0.9 (2010)	8.9 (1989)
White River below Boise Creek near Rangely (09306290)	1983-2010	723	333 (2002)	1,345 (1984)
Douglas Creek at Rangely (09306380)	1977-1995	12	7.0 (1977)	23 (1995)

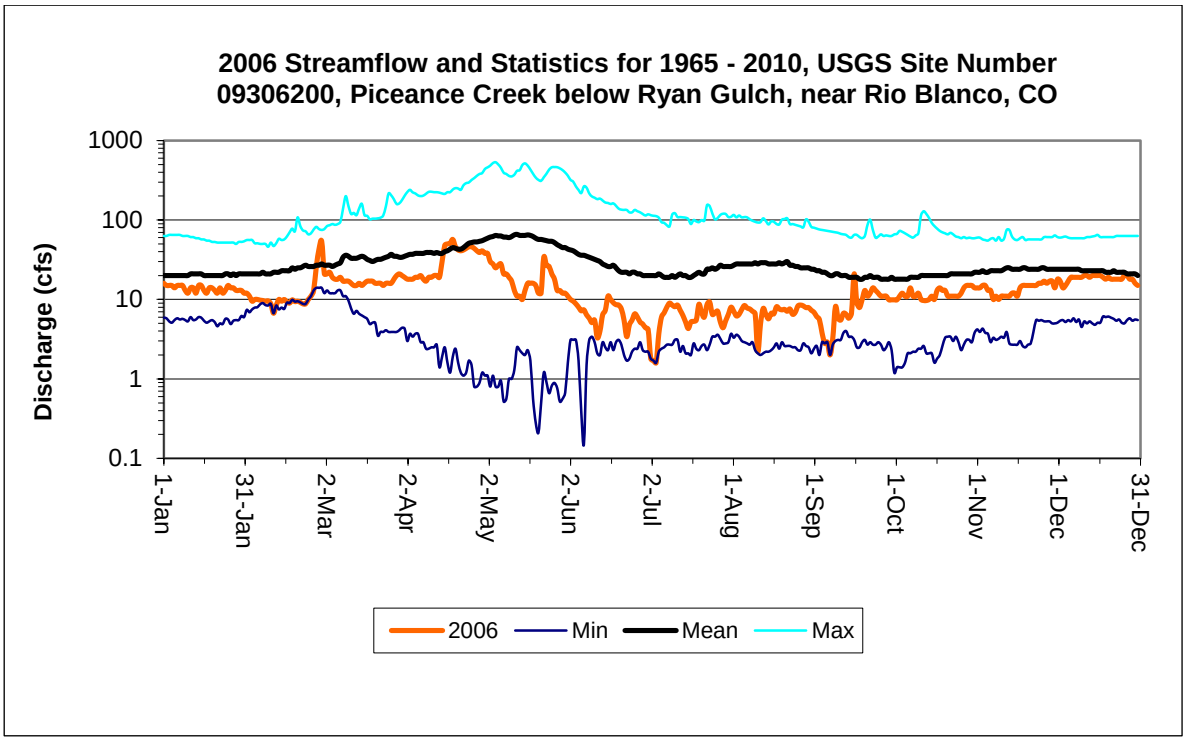
SOURCE: USGS 2011.

NOTES:

[1]Streamflow monitoring locations represent select active and inactive USGS sites in the area.

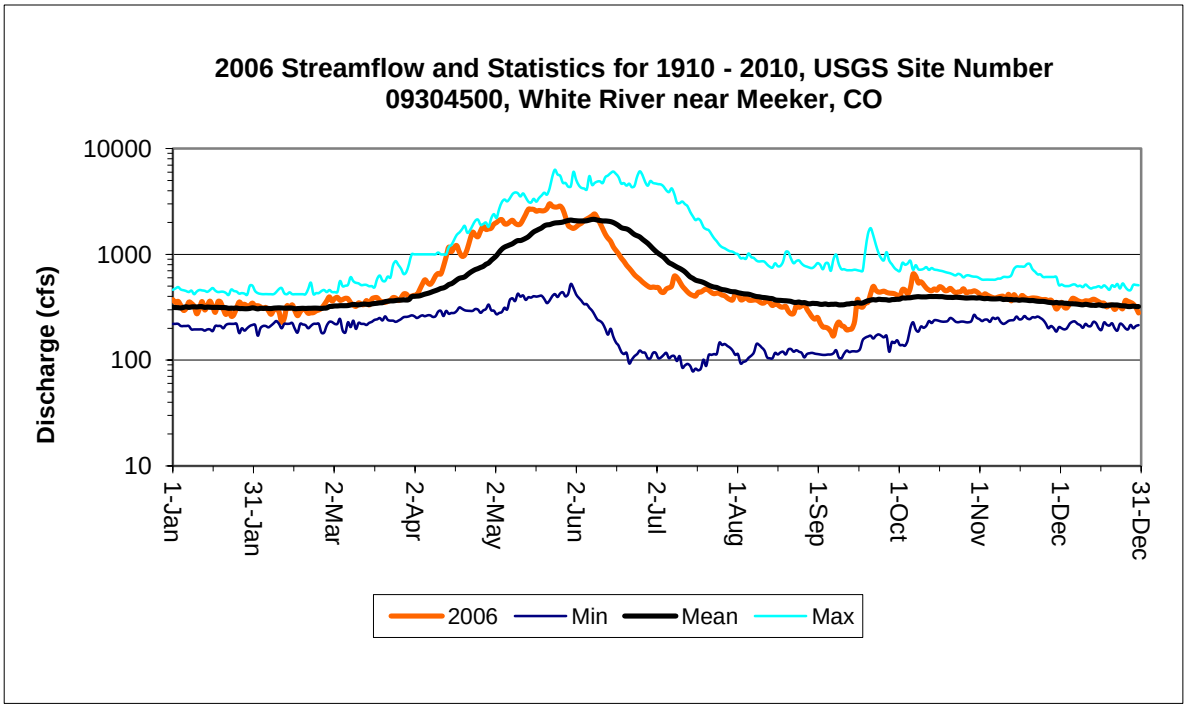
[2]cfs = cubic feet per second

Figure 3-3. Stream Hydrograph for Piceance Creek below Ryan Gulch



SOURCE: USGS 2011.

Figure 3-4. Stream Hydrograph for the White River near Meeker, Colorado



SOURCE: USGS 2011.

3.2.4.2 Water Quality

Water quality classifications and standards are assessed during project planning and permitting. Entities responsible for protecting surface water quality under the CWA are the EPA and CDPHE. Surface water protections are based on the CWA; state regulations; BLM guidance, memoranda, and directives; best scientific and monitoring practices; and environmental planning documents such as this one. Water quality is measured by the USGS, BLM, local agencies, and private parties, depending on funding and interest.

Water quality classifications in the WRFO Planning Area are established by CDPHE Water Quality Control Division based current conditions and beneficial uses to maintain and improve the quality of Colorado's surface waters. Classifications result in basic, numerical and site specific narrative standards that define the chemical, biological, and physical qualities of waters needed to protect the identified beneficial uses. Aquatic life beneficial uses can be for warm or cold water and are based on the abundance of species present; both classifications can be found within the MPA and the WRFO Planning Area. Recreation is protected based on human health and current and expected recreational uses of surface waters. Agriculture is protective of irrigate crops and livestock watering. Domestic water supply uses are for any surface waters that are suitable or intended to become suitable for potable water supplies.

Water quality is influenced by the type of rock and soils that water has come in contact with, as well as vegetation, groundwater interaction, and pollutants discharged into water bodies from point and non-point sources. Most of the long-term water quality sampling locations in the WRFO Planning Area are concentrated along larger drainages (such as the White River) and are managed by the USGS. Pollutants such as selenium are directly linked to upstream surface geology, which is naturally occurring, but still may lead to water quality impairments. For example, mancos shale outcrops around Meeker contribute to selenium loads in Flag and Sulphur Creek leading to an impairment of water quality standards. Saline soils and fragile soils discussed in the soils section generally correspond to areas with surface geology that contribute trace elements and dissolved solids to surface waters.

An extensive analysis of water quantity and quality analysis of the White River Basin was completed by the USGS in 1984 that included 45 water quality sites and extensive streamflow measurements (Boyle et al. 1984). The study found that water types in the upper basin are predominantly calcium-bicarbonate, but change to a sodium-calcium-sulfate-bicarbonate signature downstream. The water type changes as a result of groundwater inputs from the Meeker Dome geologic formation and inflows from Piceance and Yellow Creek. This change in chemistry can be seen in the differences in total dissolved solid (TDS) concentrations as measured in the White River, and in Piceance and Yellow Creeks. Below Yellow Creek sulfate is the dominant anion, whereas bicarbonate is the dominant anion in the White River headwaters. Dissolved solids also show a sharp increase at Meeker Dome and again at Piceance Creek. The BLM has provided support for additional streamflow and water quality monitoring at some of these sites to establish baseline conditions and monitor oil and gas development as it occurs.

Water quality typically varies as a function of flow conditions and can be impacted by water uses. The quality of runoff in ephemeral and intermittent stream channels is largely dependent upon the amount of salts, sediments, trace elements and organic materials that accumulate in dry stream channels between flow periods. Periodic flushing of accumulated salts, trace elements and sediments occurs during flow events, which represent the only time that water quality samples can be collected. The flushing of these materials helps account for the greater concentrations of dissolved and suspended solids recorded in ephemeral drainages. Factors that could govern the

accumulation of salt, trace elements and sediments include physical properties of the watershed (e.g., topography, geology, and climate), land use in the watershed, and seasonal fluctuations in temperature and precipitation.

Surface water quality would be protected to the maximum extent possible within BLM's authority (BLM 1997a). BLM will implement mitigation to protect public water supplies through support of site placement, best management practices, drilling practices and other measures during oil and gas permitting based on classifications established entities responsible for protecting the beneficial uses of surface water (EPA and the CDPHE). Most of the long-term water quality sampling locations in the WRFO Planning Area are concentrated along larger drainages (such as the White River) and are managed by the USGS (Table 3-11).

Water quality regulations could be updated by the CDPHE as much as two to four times a year with segment descriptions, classifications, and numeric standards changing as needed. The summaries provided in this document should be reviewed knowing that, although based on the latest regulations promulgated, they are subject to change based on CDPHE regulatory processes. The WRFO would adjust its future management approaches for water quality based on the most current water quality regulations, classifications and standards.

Stream segments within the WRFO Planning Area are in the Lower Colorado River Basin (Region 11), with the majority in the White River Basin. The Status of Water Quality in Colorado – 2008 (CDPHE Water Quality Control Division 2008), and Regulation No. 37: Classifications and Numeric Standards for Lower Colorado River Basin (CDPHE Water Quality Control Commission [WQCC] 2011) were reviewed for information relating to drainages within the WRFO Planning Area. The tables in Regulation No. 37 (Section 37.6) list the description, designation, classifications, and numeric standards for physical and biological parameters, inorganic constituents, and metals. Some stream segments are designated "use-protected" in these tables. If a stream segment is not designated as use-protected it is subject to the antidegradation review requirements in the CDPHE's Antidegradation Rule. For use-protected waters, only the protection specified and numeric standards given in Regulation No. 37 apply. White River Basin segment 13a including all tributaries to the with river from Piceance Creek to Douglas Creek is the most prominent use protected segment in the WRFO Planning Area.

Classifications for stream segments in the WRFO are generally for cold water aquatic life in the perennial headwaters and warm water aquatic life in ephemeral, intermittent and lower elevations of perennial stream segments. Agricultural uses are generally protected for all stream segments in the WRFO. Existing primary contact recreation is protected in the mainstem of the White River for boating and fishing and potential or non-primary contact use is typically protected in for perennial waters. Domestic water supply is protected in the mainstem of the White River and many of the larger tributaries, but not in Yellow or Piceance Creeks.

Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List (Section 303(d) list) was updated for 2012 became effective, March 30,2012 in Regulation No. 93 (5 Code of Colorado Regulations [CCR] 1002-93). Regulation No. 93 is the State's Section 303(d) list of water-quality-limited segments requiring Total Maximum Daily Loads (TMDL) monitoring. A TMDL is a calculation of the maximum amount of a pollutant that a water body could receive and still meet water quality standards. The 2010 303(d) list and the monitoring and evaluation list included twelve river segments that are at least partially within the WRFO, including eight segments within the White River drainage, one segment within the Yampa River drainage, and three segments that drain into the lower Colorado River. The updated 2012 303(d) list included the majority of the

old listing, four new provisional listings for aquatic life standards, a new listing for pH in Rio Blanco Reservoir, and a new listing for aquatic life and total recoverable iron on Yellow Creek. The Monitoring and Evaluation List included a new listing for Duck Creek for aquatic life standards.

Table 3-11. Water Chemistry Results for Selected USGS Surface Water Quality Stations in the WRFO Planning Area

Stream Name and Location	White River Below Meeker, CO		Piceance Creek Below Ryan Gulch, Near Rio Blanco, CO		Yellow Creek Near White River, CO		White River Below Boise Creek, Near Rangely, CO	
USGS Site Number	09304800		09306200		09306255		09306290	
Sample period	1961–2008		1964–2008		1965–2008		1982–2008	
Number of samples[1]	885		823		722		603	
Parameter	**Mean Result**	**No. of Analyses**	**Mean Result**	**No. of Analyses**	**Mean Result**	**No. of Analyses**	**Mean Result**	**No. of Analyses**
Mean Temperature (°C)	9.0	846	10.7	703	12.7	502	13.3	532
Max. Temperature (°C)	26.0	846	---	---	---	---	---	---
Mean Discharge (cfs)	110	105	---	---	---	---	---	---
Min. Discharge (cfs)	68.0	105	---	---	---	---	---	---
Max. Discharge (cfs)	163	105	10.7	703	12.7	502	13.3	532
pH	8.25	463	8.28	276	8.60	162	8.40	173
Conductance[2] (mean)	552	650	1,570	372	3,410	310	643	378
Conductance (min.)	220	_	600	_	460	_	268	_
Conductance (max.)	1,100	_	2,800	_	5,200	_	1,040	_
TDS[3] (mean)	354	271	1,160	34	2,770	3	368	7
TDS (min.)	140	_	861	_	2,530	_	204	_
TDS (max.)	609	_	1900	_	3,040	_	455	_
TSS[4] (mean)	32.0	19	NM[5]	_	NM	_	NM	_
Turbidity, NTU[6]	16.1	32	4.0	2	1,080	11	49.3	15
Calcium	65.7	395	80.4	239	41.4	163	63.8	93
Magnesium	18.4	394	81.3	239	131	164	26.4	93
Potassium	1.82	372	3.11	238	3.95	162	1.76	84
Sodium	25.8	373	180	238	679	162	46.2	84
Sulfate	124	374	389	238	695	162	173	85
Chloride	20.6	409	16.4	239	111	164	11.8	85
Iron, micrograms per liter (µg/L)	35.9	111	38.9	167	39.0	63	26.9	68
SAR (Sodium Adsorption Ratio)	0.71	373	3.37	238	12.1	161	1.18	83
Bicarbonate[2]	166	204	645	158	1,510	52	190	3

Table 3-11. Water Chemistry Results for Selected USGS Surface Water Quality Stations in the WRFO Planning Area

Stream Name and Location	White River Below Meeker, CO		Piceance Creek Below Ryan Gulch, Near Rio Blanco, CO		Yellow Creek Near White River, CO		White River Below Boise Creek, Near Rangely, CO	
Parameter	**Mean Result**	**No. of Analyses**	**Mean Result**	**No. of Analyses**	**Mean Result**	**No. of Analyses**	**Mean Result**	**No. of Analyses**
Hardness ($CaCO_3$)	240	394	538	239	645	163	268	93
Dissolved Oxygen	10.1	196	9.86	249	10.1	166	9.60	154

SOURCE: USGS 2011. Water Quality Samples for the Nation.

NOTES:

(1) Total number of grab samples analyzed; not every parameter was analyzed in every sample.
Conductance is reported in units of micromhos per centimeter (µmhos/cm).
Residue on evaporation, dried at 180 degrees Celsius, water, filtered, milligrams per liter.
Total concentration; except as noted here, reported values represent dissolved concentrations.

(2) Units are milligrams per liter, except as noted.

(3) TDS= Total dissolved solids, reported in milligrams per liter

(4) TSS = Total Suspended Solids (mean), reported in milligrams per liter

(5) NM = Not measured.

(6) NTU= Nephelometric turbidity units

Listed Segments of the White River Basin

- Segment 07, mainstem of the White River from a point above the confluence with Miller Creek to a point immediately above the confluence with Piceance Creek, specifically the White River below Meeker (on the monitoring and evaluation list for copper).
- Segment 09a, tributaries to the White River from North and South Forks to Piceance Creek, not with the boundary of National Forest lands except segments 9b and 10b, specifically Strawberry Creek (on the monitoring and evaluation list for copper and zinc).
- Segment 09d, Sulphur Creek and tributaries from source to White River, Flag Creek and tributaries from the East Fork of Flag Creek to the White River (on the impairment list for selenium with a low priority for TMDL development).
- Segment 10b, mainstem of Coal Creek, including all tributaries from the source to the confluence with the White River (on the monitoring and evaluation list for selenium).
- Segment 11, Rio Blanco Reservoir (on the impaired list for pH with a high priority for TMDL development).
- Segment 13b, Duck Creek tributary to Yellow Creek (on the monitoring and evaluation list for aquatic life).
- Segment 13c, Mainstem of Yellow Creek from Barcus Creek to the confluence with the White River (impaired for total recoverable iron and aquatic life with a low priority for TMDL development).
- Segment 14a, Mainstem of Piceance Creek from Willow Creek to Hunter Creek (impaired for total recoverable iron with a high priority for TMDL development).
- Segment 15, Mainstem of Piceance Creek from Ryan Gulch to the confluence with the White River (provisionally listed as impaired for aquatic life with a low priority for TMDL development).

- Segment 16, all tributaries to Piceance Creek, including all wetlands, lakes and reservoirs, from the source to the confluence with the White River, specifically Ryan Gulch (on the monitoring and evaluation list for *Escherichia coli* [also called *E. coli*]).
- Segment 20, Mainstem of Black Sulphur Creek from the source to the confluence with Piceance Creek (provisionally lists as impaired for aquatic life with a low priority for TMDL development).
- Segment 22, tributaries to the White River, from the confluence of Douglas Creek to the Colorado/Utah border, specifically West Evacuation Wash (or Creek) above the Utah border and the lower section of Douglas Creek (sediment impairments with a low priority for TMDL development).
- Segment 23, mainstem of East Douglas Creek and West Douglas Creek including all tributaries from their sources to the confluence, specifically East Douglas Creek (on the monitoring and evaluation list for total recoverable iron). West Douglas Creek from the source to the confluence with East Douglas (provisionally listed for aquatic life with a low priority for TMDL development).

Listed Segments in the Yampa River Basin

- Segment 03c, Yampa River, Milk Creek and tributaries from CR 15 to the Yampa River, specifically Stinking Gulch (on the monitoring and evaluation list for copper, iron, selenium, and zinc).

Listed Segment in the Lower Colorado River Basin

- Segment 10, East Rifle Creek, West Rifle Creek and Rifle Creek, including tributaries from Rifle Gap to the Colorado River (on the monitoring and evaluation list for *E. coli* and impaired for selenium with a low priority for TMDL development).
- Segment 14b, Clear Creek from Tom Creek to Roan Creek, including tributaries from Clear Creek to Kimball Creek (on the monitoring and evaluation list for *E. coli* and total recoverable iron).

Fragile Watersheds

The 1997 White River RMP included a list of fragile watersheds in Appendix D, Table 2-1 (BLM 1997a). Streams listed on Table 2-1 had Watershed Action Plans (WAPs) or were candidates for a WAP. Currently, BLM considers many of the fragile watersheds listed in the 1997 White River RMP as "high priority" watersheds. This includes the watersheds associated with Wolf Creek, Evacuation Creek, Douglas Creek, Cathedral Creek, Willow Creek in the Douglas Creek watershed, Soldier Creek, Black Sulphur Creek, Willow Creek in the Piceance Creek watershed, Piceance Creek, and Yellow Creek. Many of these creeks are considered high priority because of their proximity to future oil and gas development. This is particularly true for creeks in the Piceance Creek watershed, which roughly coincides with the MPA. The BLM's future plans for these high priority watersheds could include implementing measures to maintain aquatic habitat for current fish populations and macorinvertrabrate communities, streamflow monitoring, water quality sampling, performing flow surveys and designing projects that would maintain or improve the conditions of these watersheds on stream segments that pass through BLM lands. Collectively, stream segments listed in Regulation No. 93, and perennial stream segments in fragile watersheds designated by the BLM, are highlighted on Map 3-1 as high priority stream segments.

3.2.4.3 Groundwater

The geology of an area controls the occurrence, movement, and chemical characteristics of groundwater. In the WRFO Planning Area, much of the surficial geology consists of consolidated sedimentary formations with water bearing properties that are largely dependent on secondary porosity from faults, fractures, and joints. Groundwater recharge in the White River Basin primarily occurs at higher elevations where precipitation exceeds evapotranspiration. This excess precipitation remains at the surface as overland flow, or recharges shallow groundwater systems and/or bedrock aquifers.

Where groundwater occurs near the land surface it is available for plants, as well as in the alluvium of stream systems. Alluvial aquifers are present along the larger perennial, intermittent, and interrupted flow segments within the WRFO Planning Area, and are generally composed of coarse sand and gravel deposits alternating with layers of clay, silt, and sand (Van Liew and Gesink 1985). The alluvial aquifers serve as either recharge or discharge points for underlying bedrock aquifers. Groundwater discharge also occurs as a result of permeability changes at or near the ground surface (geologic contacts between formations or rock units), or from the surface expression of faults, fractures, or joints in underlying bedrock aquifers. These discharge areas are often manifested as groundwater springs or gaining stream segments. Faults, improperly abandoned well bores, fractures, and joints could also provide a pathway for the mixing of shallow, low-salinity groundwater and non-tributary water such as saline deep basin waters.

Groundwater quality and chemistry depends on the lithology and mineral composition of the aquifer and any upgradient formations that the groundwater flowed through. Aquifer properties such as hydraulic conductivity and primary and secondary porosity also influence water quality based on the residence time of the groundwater in the subsurface. Finer grained rocks such as claystone and shale typically have lower permeabilities and contain more mineral types than sand and gravel units. The mineral content of several of the sedimentary formations underlying the WRFO Planning Area includes relatively high amounts of soluble minerals and salts. These soluble zones include sodium bicarbonate (nahcolite) and sodium chloride (halite) deposited in lacustrine mudstones. The nahcolite occurs as interbeds with the oil shale units, which were also deposited in a lacustrine environment. Where sodium bicarbonate and other salts have been leached into solution, the end result is groundwater with high dissolved mineral concentrations.

Groundwater in the Piceance Creek Basin

Scientists have used the term Piceance Creek Basin to describe the geographic area between the White River on the north, the Colorado River on the south, the Douglas Creek Arch on the west and the Grand Hogback on the east (MacLachlan 1987). This area generally corresponds to the MPA, and contains most of the Yellow Creek watershed, all of the Piceance Creek watershed, and a small portion of the Upper Colorado River basin in the headwaters of Parachute and Roan Creeks.

Most of the understanding of groundwater resources in the Piceance Creek Basin is based upon studies completed in the late 1970s and early 1980s during a period of intense focus on oil shale development. More recently, field activities associated with oil shale Research, Development, and Demonstration (RD&D) leases and nahcolite solution mining have resulted in monitoring well establishment and studies of the groundwater systems in the Piceance Creek basin (USGS 1987). The conceptual hydrogeologic model for the area is evolving as more data is collected.

The simplest hydrogeologic model that has been used for the Piceance Creek Basin consists of three major aquifers: an alluvial aquifer, an upper aquifer, and a lower aquifer (Weeks and Welder 1974).

However, most studies by the USGS in the 1970s and early 1980s described two bedrock aquifer zones, one within the Uinta Formation and another in the Green River Formation. The Green River Formation could be further subdivided into an upper and lower aquifer separated by a confining unit called the Mahogany zone. Throughout the remainder of this document, aquifers within the Uinta Formation and the upper Green River will be referred to as the Upper aquifers, and those in the Green River Formation below the Mahogany zone will be referred to as the Lower aquifers.

The Upper aquifers are generally within layers of permeable sandstone and fractured siltstone. The Lower aquifers occur within fractured lean oil shale. Oil shale is a kerogenous marlstone, i.e., a calcium carbonate or lime-rich mud or mudstone, deposited in rich (greater than 25 gallons of oil per ton of rock) and lean (lower oil assay value) layers. Within these mudstones are blebs, seams, and beds of nahcolite. Dissolution and leaching of the nahcolite salts has formed continuous intervals of voids that could be linked by faults and joints, resulting in zones of higher permeability and movement of groundwater. Near the paleobasin-center, the nahcolite units are thicker and are of very low permeability. This nahcolite zone could act as a barrier to flow, and in some cases, could facilitate the upward migration and mixing of deeper saline waters in the lower aquifers with less saline waters in the upper aquifers.

Taylor (USGS 1987) describes the Mahogany zone as an aquiclude for the lower aquifers. However, a more appropriate term could be aquitard or leaky aquiclude, since the low permeability of the Mahogany zone retards, but does not completely restrict, water movement between the upper and lower aquifers. The average thickness of the upper aquifers was estimated at 700 feet, compared to 900 feet for the lower aquifers and 160 feet for the Mahogany zone.

Although the hydrogeologic conceptual model just described could be accurate for parts of the basin, a more recent investigation indicated that the primary confining unit in the Parachute Creek Member is the R5 layer, which is located several hundred feet below the R7 or Mahogany Zone (BLM 2006b). This finding was based on a review of potentiometric surface elevations at a number of groundwater monitoring well clusters installed at oil shale test sites. During the same study, a downward hydraulic gradient was observed at 15 of 16 monitoring well clusters screened above and below the R5 Unit.

An upward hydraulic gradient was observed at one well across the R5 Unit, which provides an indication of the mechanism for upward migration of groundwater through both the R5 and Mahogany zones. Vertical groundwater flow in the lower aquifers occurs within fractures and associated dissolution zones, and in the overlying aquifers (particularly the Uinta Formation), groundwater flow occurs within permeable sandstone and fractured siltstone (USGS 1987). These fractures and dissolution features act as preferred pathways for vertical groundwater flow between the upper and lower aquifers. Where hydraulic head in the lower aquifers is higher than the upper aquifers, mixing of water types could occur. Variations in groundwater recharge along the basin margin could also result in lower hydraulic heads that could facilitate mixing of waters from different aquifers and allow for migration of fluids.

Groundwater Quantity

Surface expression of groundwater occurs naturally through springs that originate from confined bedrock aquifers and unconfined alluvial aquifers. Springs from confined aquifers typically arise from relatively deep groundwater that follows fractures, old well bores, faults and/or joints to the surface. Variations in permeability across alluvial aquifers in the Piceance Creek Basin could be responsible for the groundwater-dominated hydrographs of Piceance and Yellow Creeks.

Stream systems that are dominated by groundwater typically exhibit a flat hydrograph due to relatively consistent rates of groundwater discharge. Other causes could also be responsible for flat hydrographs, most notably irrigation. However, rivers that display flat hydrographs from irrigation will typically have significant upstream storage reservoirs. In the case of Piceance Creek, water is withdrawn for irrigation, but no substantial reservoir storage is present along the stream channel. Consequently, groundwater discharge (rather than irrigation) is the likely driver for the relatively flat Piceance Creek hydrograph (see Figure 3-3). This groundwater input to surface water could also be observed in water quality changes along the White River (refer to Section 3.2.4.2, Groundwater).

Exploratory drill holes completed in the alluvium along Piceance and Yellow Creeks have helped explain the groundwater-surface water interactions that occur along the creek channels. One exploratory drill hole completed in the Piceance Creek watershed just upstream from the Willow Creek confluence showed 70 feet of highly permeable sand and gravel alluvium. Another drill hole located 8 miles downstream at the junction of Piceance Creek and Ryan Gulch indicated that the alluvium was composed of 70 feet of dense organic clay, with low permeability. Similar trends were observed along Yellow Creek, where the alluvium at an upstream location consisted of 35 to 45 feet of saturated sand and gravel. In contrast, at a location just 5 miles downstream, the alluvium consisted of 80 feet of dense organic clay (Welder 1987).

As a result of these permeability differences, Piceance and Yellow Creeks are predominantly losing streams in their upper reaches, but transition to gaining streams as lower permeability alluvium is encountered. This also leads to streams with interrupted flows (no surface expression along portions of an otherwise intermittent or perennial system), and periodic surface expression of groundwater as water in the alluvium is forced to the surface. The upwelling of groundwater in lower permeability materials also results in the formation of groundwater springs from bedrock aquifers along these stream channels.

In the WRFO Planning Area, perched groundwater zones occur locally within the Uinta Formation within the Piceance Creek Basin. These perched groundwater zones manifest themselves as springs and seeps above the valley floors in outcrop areas (Weeks and Welder 1974; Cole et al. 1995). Water bearing formations within the Uinta can be access by wells. These Uinta aquifers provide viable sources of well water for livestock watering and may be the best source of drinking water in this area (Welder and Saulnier 1978).

Groundwater Use

Groundwater in the WRFO Planning Area provides an important source of water in this area for livestock grazing, domestic and household supplies, wildlife, and oil and gas activities. Over 700 springs have been documented throughout the WRFO Planning Area, and the BLM has filed for water rights on approximately half of them for stock watering and wildlife uses. There are also many wells that have been completed in alluvium and deeper aquifers that are used as water sources. Range improvement projects have been built for some of these wells and springs. In addition to wildlife and stock watering, groundwater in the WRFO Planning Area is used for natural gas and oil development activities, solute mining (i.e., solution mining of nahcolite), and oil shale RD&D lease activities.

Colorado distinguishes between tributary and non-tributary groundwater in the regulation of groundwater use. Water that discharges naturally from aquifers to streams is called tributary groundwater. Groundwater that does not naturally discharge into streams is called non-tributary groundwater. Tributary groundwater could occur in bedrock or alluvial aquifers. Wells completed in aquifers that contain tributary groundwater are considered along with surface water rights.

Non-tributary groundwater is regulated based on the volume of storage in the aquifers. In the absence of a competing water right, a landowner is allowed to pump from non-tributary wells a maximum of one percent per year of the estimated volume of groundwater stored below their land.

Groundwater Quality

Weeks and Welder (1974) compiled groundwater chemistry data for the alluvial aquifer, as well as for the upper and lower bedrock aquifers. The alluvial aquifers had 27 samples collected from wells located along Piceance Creek, Yellow Creek, Ryan Creek, Black Sulphur Creek, and Fawn Creek. Water from these wells is typically classified as a sodium bicarbonate type with TDS concentrations ranging from 470 to 6,700 mg/L. Higher TDS values were typically observed along the downstream segments, and could reflect the influence of groundwater discharge of water from deeper portions of the basin.

The assessment of groundwater quality for the upper aquifers was based on 17 samples that generally exhibited a sodium bicarbonate water type, with TDS values ranging from 350 to 2,180 mg/L for the saturated portion of the Uinta Formation and 610 to 3,300 mg/L for the Parachute Creek Member. For the lower aquifers, the groundwater quality assessment was based on 27 samples. The lower aquifers typically displayed a sodium bicarbonate-chloride water type with TDS concentrations ranging from 490 mg/L along the basin margin to 38,900 mg/L in the center of the basin near the nahcolite zone.

As reported by Saulnier (1999), groundwater quality in the bedrock aquifers is largely described by TDS concentrations. The TDS concentrations change markedly both vertically and horizontally within the basin depending upon the proximity of groundwater to soluble saline mineral deposits in the Parachute Creek Member (Saulnier 1999; BLM 2006b). The suitability of groundwater for use by livestock, wildlife, domestic and household use and/or industry may be determined by the dissolved solids concentrations.

The TDS concentrations are lowest in higher elevation recharge areas present around the basin margins (400 to 800 mg/L), and generally increase to the north, where groundwater discharges to the lower reaches of Yellow and Piceance Creeks and the White River (some samples contain up to 30,000 mg/L TDS). Saulnier (1999) also described several locations in the Piceance Creek Basin where elevated TDS concentrations have been observed in the upper aquifers at locations downgradient of older exploratory well completions. Antiquated exploratory well completion practices, as well as inadequate plugging and abandonment procedures, could account for some of the inter-aquifer migration of saline waters and/or the cross-contamination of aquifers by higher TDS-containing groundwater.

Most researchers report that groundwater quality is generally better in the alluvium and the upper aquifers than in the lower aquifers, with the lower aquifers generally having higher concentrations of fluoride, boron, barium, lithium, sodium, TDS, and dissolved methane (CH_4) (Cole et al. 1995).

The WRFO Planning Area bedrock aquifers are recharged by snowmelt and precipitation that replenish the groundwater migrating through the Uinta and Green River formations. As the water percolates through these formations, minerals are dissolved and ion exchange reactions occur (USGS 1987). Zones of mixing within the upper and lower aquifers could also increase dissolved solid concentrations in groundwater. These higher TDS-containing groundwaters discharge in the northern part of the Piceance Creek Basin via groundwater springs and gaining streams such as Piceance and Yellow Creeks. The exact location and extent of hydraulic connections between aquifers, springs, and streams are not well known. BLM has funded a USGS study to look at the

surface and groundwater interaction in these zones and salinity dynamics which are important to shaping water quality in Piceance and Yellow Creek.

The groundwater chemistry of the upper bedrock aquifers is dominated by dissolved calcium, magnesium, and bicarbonate along the rim of the basin; and by sodium, magnesium, bicarbonate, and sulfate in the central part of the basin (USGS 1987). In the Alkali Flats area in the Piceance Creek watershed below Dry Fork, bicarbonate concentrations in surface water increase by several hundred milligrams per liter compared to the surrounding area. This change in surface water quality is caused by the discharge of relatively high TDS-containing groundwater from the upper and possibly lower aquifers, as a result of the extensive fracture network present in the bedrock zones. Extensive salt deposits could be observed in this area at ground surface during low-flow conditions, and have given rise to the Alkali Flats designation. During higher flow periods, the same salts are dissolved and flushed back into Yellow and Piceance Creeks.

Special state water quality classifications of interest in the WRFO include a special regulation imposed for the Rangely Oil and Gas field in Rio Blanco County. This field is exempt from Colorado basic groundwater standards (Regulation No. 41) for select organic constituents, unless the origin of the compounds is caused by exploration or production activities.

The State of Colorado's source water protection program identifies aquifers for special protection because of their beneficial uses such as municipal water supplies. For example, groundwater in unconfined and confined aquifers present beneath the Meeker well field (just east of Meeker in the White River Valley alluvium) has been designated as Domestic Use and Agricultural Use-Quality. Aquifers may contain trace elements such as selenium that where eroded from land surfaces in soils with high amounts of these trace elements, such as soils derived from Mancos Shale. As surface waters containing these trace elements interact with stream alluvial aquifers these aquifers and any domestic water sources in these aquifers may contain elevated amounts of these elements. In a similar way nutrients and pesticides associated with land uses may become elevated in stream aquifers and domestic wells due to surface water sources.

Groundwater protection zones for public water supplies have been identified for Dinosaur, Massadona, and for campgrounds and the headquarters of Dinosaur National Monument. Oil and gas development is unlikely near these public water supplies since only 5 percent of the development is expected outside the MPA. There are no public water supplies that obtain drinking water from groundwater within the MPA, however there are many wells that are permitted for domestic and household use. The Safe Drinking Water Act presumes that aquifers are Underground Sources of Drinking Water (USDWs), unless they are specifically exempted or if they have been shown to fall outside the definition of USDW (e.g., over 10,000 mg/L total dissolved solids or from a mineral producing zone).

The majority of wells permitted for domestic and household use in the MPA, where 95 percent of the new natural wells are expected, are completed in the Uinta formation, but some are completed in the upper aquifer zones in the Parachute member of the Green River formation. The BLM has established one groundwater monitoring well completed in the Uinta and several completed in the upper aquifer zones in the Parachute member of the Green River formation to monitor these aquifers. Outside the MPA the majority of wells permitted for domestic and household use would be completed in the White River alluvium and alluviums of perennial streams that are tributary to the White River.

3.3 Biological Resources

3.3.1 Vegetation Communities

Table 3-12, summarizes the extent in terms of acres and percent of five vegetative types that comprise the WRFO Planning Area (i.e., vegetation on BLM land). The vegetative types presented here reflect those found in the White River Resource Area Draft RMP and EIS (BLM 1994). Forest and woodlands followed closely by shrubland dominate vegetation in the WRFO administered lands. The remaining vegetative types within the administered area are far less common.

Table 3-12. Acres and Percent Cover of Vegetative Types within the WRFO Planning Area

Vegetative Type	Acres	Percent
Forest and woodlands	**685,600**	**47**
Pinyon/juniper woodlands	636,200	44
Ponderosa pine, lodgepole, and spruce/fir woodlands	30,700	2
Aspen forests	18,700	1
Riparian areas	**9,500**	**0.6**
Grasslands	**74,400**	**5**
Shrublands	**659,300**	**45**
Sagebrush	456,600	31
Salt desert	100,400	7
Foothill/mountain shrub	102,300	7
Developed and Non-vegetated Land	**26,300**	**2**
Total	**1,455,100**	**100**

SOURCE: WRFO GIS data 2009.

The vegetative types presented in Table 3-12 are described below under the following five categories: (1) forest and woodlands; (2) riparian and wetland communities; (3) grassland and shrubland communities; (4) invasive, non-native plant species (INPS) and pest control, and (5) remnant vegetation. Existing conditions of vegetative resources are addressed to the extent possible based upon available data.

3.3.1.1 Forests and Woodlands

This section describes existing conditions for forests and woodlands, as well as old-growth characteristics and forest and woodland health. This section also discusses management of forests and woodlands.

Forest and Woodland Communities

Forests and woodlands cover 685,600 acres (47 percent) of the WRFO Planning Area. The forest and woodland cover type found at the lowest elevation in the WRFO Planning Area is pinyon/juniper woodlands and the highest is spruce/fir forest. Other forest types are found at various elevations, in between, and include quaking aspen (*Populus tremuloides Michx.*), few scattered stands of ponderosa pine (*Pinus ponderosa*), and lodgepole pine (*Pinus contorta*) communities. Herbaceous cover within woodlands is generally very low, although some areas, with openings, could have a substantial understory (including shrubs).

Pinyon/Juniper

Pinyon/juniper woodlands cover 636,200 acres (44 percent) of the WRFO Planning Area. This vegetation community is mostly found between 5,200 and 8,000 feet on somewhat xeric ridgetops (BLM 1994). It is the climax association in these locations and varies from an open to closed canopy with a highly variable understory of shrubs and herbaceous plants. Old growth pinyon/juniper and areas with a greater dominance of juniper generally have less understory vegetation (BLM 2007b). Dominant plants in this community include pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus utahensis*), Gambel oak (*Quercus gambeli*), sagebrush (*Artemisia* spp.), mountain mahogany (*Cercocarpus* spp.), and many of the herbaceous species listed under the sagebrush shrubland community described in Section 3.3.1.3.

Expansion of pinyon and/or juniper into previously non-wooded areas occurred prior to Euro-American settlement on at least some sites; it is not strictly a 20th century phenomenon, and is a normal process caused by past land use or fire exclusion. Expansion of pinyon and/or juniper into previously non-wooded areas could have been more extensive in the 20th century than in the previous few centuries because of grazing and fire exclusion, at least in some regions (Romme et al. 2007). Pinyon and/or juniper woodlands expansion has occurred into more productive areas for fire and has increased fuel loading in much of the western U.S. including the WRFO Planning Area (Hood and Miller 2007).

Ponderosa Pine, Lodgepole, and Spruce/Fir

The combination of ponderosa pine, lodgepole, and spruce/fir woodlands encompasses about 30,718 (2 percent) of the WRFO Planning Area. This vegetation community is scattered throughout the eastern and southern portions of the WRFO Planning Area.

Ponderosa pine forests are generally found between 6,000 and 8,000 feet (BLM 2007b). They generally occur on higher mesas and mountain slopes, and could contain substantial amounts of Douglas fir (*Pseudotsuga menziesii*), aspen, or pinyon/juniper woodlands. Healthy ponderosa pine forests have somewhat open canopies and contain a substantial understory of shrubs and grasses. This type of structure provides more year-round forage for wildlife than most other coniferous forest types. Herbaceous plants found in this community typically include many of those listed for foothill/mountain shrubland described under Section 3.3.1.3.

Lodgepole pine forests occur between 8,000 and 10,000 feet (Kingery 1998). This community represents an early successional stage and is the result of past stand-replacing fires. In these stands, the community is usually dominated by dense monocultures of trees of similar age, but understory species like kinnikinnik (*Arctostaphylos* spp.) and others from the foothill/mountain shrubland community could be found in more open areas.

Spruce/fir forests are usually found between 7,000 and 11,000 feet. These areas typically have shallow soils and contain dense stands of Englemann spruce (*Picea englemanni*), Douglas fir, and subalpine fir (*Abies lasiocarpa*) with a closed canopy. Openings in the forest support many herbaceous and woody plants that are found in the foothill and mountain shrublands and foothill and mountain grassland communities discussed in Section 3.3.1.3. The lower elevation spruce/fir forest areas found in the sheltered areas along the southwestern edge of the WRFO Planning Area contain mostly Douglas fir and very few Englemann spruce and subalpine fir.

Aspen

The aspen forests encompass about 18,700 acres (1 percent) of the WRFO Planning Area. These forest communities are usually found between 7,000 and 10,000 feet primarily in the southern

portion of the field office and along the upper elevations of Douglas Creek and Piceance Creek. This community is early successional and consists of open to dense stands of aspen in sometimes isolated pockets in higher elevations (BLM 1994). Some of these stands do not appear to be regenerating as expected. Understory vegetation is highly variable and depends mostly on available moisture and canopy closure. Many aspen forests are very productive and contain a lush understory, whereas others could have somewhat sparse understories. Plant species commonly found in the aspen trees in this community include those listed under the foothill/mountain shrubland community described in Section 3.3.1.3.

Old-Growth Forests and Woodlands

Old-growth forests and woodlands stands differ in their characteristics from earlier stages of stand development. These differences include a variety of characteristics such as tree size, accumulations of large dead woody material, the number of canopy layers and species composition, and ecosystem function (FS 1993). The FS defines old-growth forest as ecosystems distinguished by old trees and related structural features (FS 1993). The BLM has interpreted this definition to mean old-growth as typically distinguished by the following (BLM 1995):

- Large-size trees of specific species;
- Wide variation in age classes and stocking levels;
- Accumulations of large-size dead standing and fallen trees;
- Decadence in the form of broken or deformed tops and boles;
- Multiple canopy layers; and
- Canopy interspaces and understory patchiness

Five structural attributes were identified for regional consideration in developing minimum criteria for old-growth determination, with not all of them needing to be defined. The attributes were: (1) live trees in the main canopy, (2) variation in tree diameters, (3) dead trees, (4) tree decadence, and (5) number of tree canopies. The regions could also add optional attributes as criteria if they were considered important in determining old-growth (BLM 1995).

The WRFO Planning Area contains old-growth forest characteristics in the pinyon/juniper, Ponderosa pine, lodgepole, and spruce/fir vegetation communities. Specifically, the WRFO Planning Area contains areas of pinyon/juniper woodland communities with potential to contain old-growth characteristics. Suggested characteristics for old-growth pinyon/juniper stand evaluations include tree age, understory vegetation, standing or down dead woody material, and tree characteristics. Individual tree characteristics for pinyon/juniper woodlands include a flattened crown shape, large, gnarly branches throughout the living portion of the crown, and often rough and shaggy bark with relatively deep furrows (Romme et al. 2007).

Management of Forests and Woodlands

All BLM forestlands are managed under the principles of multiple use, sustained yield, and environmental quality protection in accordance with the FLPMA. Management of values and uses such as recreation, aesthetics, water quality, wildlife habitat, and wilderness, and forest health, is accomplished through an ecologically based program that emphasizes biological diversity, sustainability, and the long-term health of forests and woodlands. The forest and woodland resources within the WRFO Planning Area are shown on Map 3-2. Management actions are incorporated in the alternatives and described in more detail in Chapter 2.

Forest and woodlands in Colorado have been affected by drought, insects, and disease. Pinyon ips beetle, mountain pine beetle, spruce bark beetle, and balsam fir beetle have all been increasing in population. Aspen within the WRFO Planning Area are in varying stages of growth, although in overall decline with many stands exhibiting signs of rot (Colorado State Forest Service 2005). Drought is also a factor in the extensive mortality of mature aspen in the Piceance Basin, although these stands continue to respond with regeneration. Lack of regeneration in the aspen, possibly associated with livestock and big game management/use, is also a contributing factor to the decline observed in the resource area.

3.3.1.2 Riparian and Wetland Communities

The riparian community includes wetlands and is associated with and depends on the presence of water during some part of the growing season. This community provides the link between aquatic and upland (dry) habitats across all elevations. Typical riparian areas are lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers, streams, and shores of lakes and reservoirs with stable water levels. Excluded are such sites as ephemeral streams or washes that do not exhibit vegetation dependent on free water in the soil (BLM 2004a). Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions under normal circumstances. Wetlands include marshes, shallows, swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, springs, seeps, and riparian areas (BLM 2004a).

Riparian areas in the WRFO Planning Area (see Table 3-13) are generally small and account for a total of only 9,500 acres (0.6 percent), but are highly productive, and provide forage and/or cover for nearly all wildlife species at some point in their life cycle. A variety of vegetation types containing riparian zones and wetlands occur with the WRFO Planning Area, such as evergreen riparian forests and woodlands, mixed coniferous and deciduous forests and woodlands, deciduous dominated forests and woodlands, tall willow shrublands, short willow shrublands, non-willow shrublands, and herbaceous vegetation (Carsey et al. 2003). Riparian areas and wetlands are key in providing water quality improvement in watersheds by buffering open waterways from surface runoff that could contain sediment, toxicants, or other undesirable constituents. The location of riparian areas and wetlands for the WRFO Planning Area can be found on the FWS National Wetlands Inventory maps, WRFO GIS layers (streams, rivers, lakes, springs, vegetation, and proper functioning condition assessment), aerial photos, USGS quadrangle maps, and WRFO specific mapping of lentic and lotic resources. Management actions pertaining to riparian and wetlands are incorporated in the alternatives and described in more detail in Chapter 2.

Riparian Proper Functioning Condition

BLM resource specialists record information on the condition of various riparian resources in the WRFO Planning Area. During these assessments, riparian systems and wetlands are evaluated using a qualitative assessment method called Proper Functioning Condition (PFC) (BLM 1998). On the basis of hydrology, vegetation, and erosion/deposition (soils) attributes and processes, the PFC assessments place the riparian area in one of five ratings: PFC, Functional At-Risk (FAR) with an upward trend (FAR-UP), FAR not apparent trend (FAR-NA), FAR with a downward trend (FAR-DOWN), and Non-Functional (NF).

The approach of the PFC assessment is to evaluate most of the indicators for the Colorado Standards for Public Land Health Standard 2. The resultant functional rating (PFC, FAR, NF) for each riparian area determines whether the standard is being achieved. A PFC rating means most or all of the indicators (within the system's potential) have been met and Standard 2 has been achieved.

A FAR-UP rating generally means that several indicators have not been met but that significant progress is being made toward achieving Standard 2. A FAR-DOWN or FAR-NA rating means several indicators have not been met and generally Standard 2 would not have been achieved. Likewise, a NF rating means that critical indicators have not been met and consequently Standard 2 has not been achieved.

For lotic systems, a riparian-wetland area is considered to be in PFC when adequate vegetation, landform, or large woody debris is present to accomplish the following:

- Dissipate stream energy associated with high water flow, thereby reducing erosion and improving water quality
- Filter sediment, capture bed load, and aid flood plain development
- Improve floodwater retention and groundwater recharge
- Develop root masses that stabilize streambank against cutting action
- Develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses
- Support greater biodiversity (BLM 1998).

For lentic systems, riparian-wetland areas are functioning properly when adequate vegetation, landform, or debris is present to accomplish the following:

- Dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality
- Filter sediment and aid flood plain development
- Improve floodwater retention and groundwater recharge
- Develop root masses that stabilize islands and shoreline features against cutting action
- Restrict water percolation
- Develop diverse ponding characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterbird breeding, and other uses
- Support greater biodiversity (BLM 1999a).

Each riparian-wetland area has to be judged against its capability and potential (1998 Technical Reference BLM-RS-ST-98-001+1737) (BLM 1998). In the WRFO Planning Area, a total of 381.5 miles of riparian areas along 72 different waterways have been inventoried and 292.7 miles assessed. Table 3-13 summarizes the number of miles of high priority, medium priority, low priority, and other stream segments that are PFC, FAR, or NF within each geographic reference area. Of the miles assessed, 78.9 miles are rated as PFC, 89.3 miles are rated as FAR, and 124.5 miles are rated as NF. Riparian-wetland areas are shown in Map 3-2. Causal factors for not getting a rating of PFC include: trampling by domestic or wild animals, presence of invasive plant species, and/or degraded stream channels (e.g., downcutting, unstable banks, excessive erosion or deposition).

Table 3-13. Number of Stream Miles within each Geographic Reference Area in PFC, FAR, or NF

Geographic Reference Area (GRA)	Functional Rating (miles)			
	PFC[1]	FAR[2]	NF[3]	Total
High Priority Riparian Habitats				
Douglas Creek/Cathedral GRA	40.3		11.2	51.5
Crooked Wash/Deep Channel GRA	0.4	7.6	2.5	10.5
Piceance Basin GRA	11.4	21.6	16.3	49.3
Blue Mountain/Moosehead GRA	2.0	5.9	6.6	14.5
Medium Priority Riparian Habitats				
Douglas Creek GRA	14.5	16.4	10.7	41.6
Crooked Wash/Deep Channel GRA	1.7	16.7	3.5	21.9
Piceance Basin GRA	2.9	18.1	50.3	71.3
Blue Mountain/Moosehead GRA		1.4	5.5	6.9
Wolf Creek/Red Wash GRA	1.0	1.3	5.8	8.1
Low Priority Riparian Habitats				
Piceance Basin GRA			1.0	1.0
Douglas Creek GRA	3.5	1.7	3.6	8.8
Crooked Wash GRA	2.0			2.0
Other				
Blue Mountain/Moosehead GRA	1.0		7.3	8.3
TOTAL	**78.9**	**89.3**	**124.5**	**292.7**

SOURCE: BLM 1994; BLM 2006b.

NOTES:

[1]PFC = proper functioning condition

[2]FAR = functional at-risk

[3]NF = non-functional

3.3.1.3 Grassland and Shrubland Communities

Based on data from a limited number of livestock grazing Environmental Assessments (EAs), since 1997 upland areas that were analyzed were primarily achieving or making progress toward achieving Colorado Standards for Public Land Health Standard 3 (healthy, productive plant communities) (BLM 1997b). In areas that were not achieving or making progress toward achieving Standard 3, historic grazing practices and weed invasion (e.g., cheatgrass [*Bromus tectorum*]) were indicated as the main causal factors for these determinations.

Grasslands

Grasslands are very diverse in the WRFO Planning Area and include lowland, foothill, mountain, and alpine areas. They cover a total of 74,400 (5 percent) of the WRFO Planning Area and their composition is dependent on soil type, land use, aspect, and elevation. Most of these areas are located in valley bottoms, uppermost south-facing slopes, and in scattered patches on windswept ridges (BLM 1994). Grasslands in the WRFO Planning Area have the potential to provide good

forage for many wildlife species and livestock, although heavy grazing or other land use practices could adversely affect the composition and productivity of some areas.

Lowland

Lowland grasslands (below 5,500 feet) are generally dominated by native and non-native grasses with various forbs. Many of these lowland areas could have been naturally dominated by woody vegetation or shrublands, but due to irrigation, fire, land clearing, and other land use practices, are currently grasslands. Most of these areas are actively grazed by livestock and wildlife and are dominated by grasses like Colorado wildrye (*Leymus ambiguus*), Salina wildrye (*Leymus salinus*), Indian ricegrass (*Achnatherum hymenoides*), squirreltail (*Elymus elymoides*), western wheatgrass (*Pascopyrum smithii*), beardless bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg bluegrass (*Poa secunda*), brome (*Bromus* spp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), buckwheat (*Eriogonum* spp.), and penstemon (*Penstemon* spp.) (BLM 1994). Many lower elevation grasslands are degraded and are dominated by cheatgrass.

Foothill / Mountain

Foothill/mountain grasslands are generally located between 5,500 and 9,000 feet and mostly on south-facing slopes and ridgelines. They are usually naturally dominated by grasses but could also include scattered forbs and shrubs. Foothill/mountain grasslands are generally highly productive systems that support a wide range of plant and animal diversity. Much of this community, combined with adjacent shrublands, is used as winter range for deer, elk, and pronghorn. Common grasses include Idaho fescue (*Festuca idahoensis*), Thurber's fescue (*Festuca thurberi*), mountain muhly (*Muhlenbergia montana*), needle and thread (*Hesperostipa comata*), Junegrass (*Koeleria macrantha*), slender wheatgrass (*Elymus trachycaulus*), Sandberg bluegrass, Kentucky bluegrass (*P. pratensis*), and Letterman's needlegrass (*Achnatherum lettermanii*) (BLM 1994). Lowland grassland species that are also found at these elevations include Indian ricegrass, squirreltail, western wheatgrass, beardless bluebunch wheatgrass, Sandberg bluegrass, brome, arrowleaf balsamroot, buckwheat, mutton bluegrass (*P. fendleriana*), and penstemon.

Alpine

The alpine grasslands include grasslands above 9,000 feet and tundra above 11,500 feet. This community is confined to the Flat Tops Wilderness along the eastern edge of the WRFO Planning Area. This area is highly productive in mid-summer, but has an extremely short growing season due to the elevation. Large herds of ungulates and many other species of wildlife use this community during the summer for forage, nesting, and brood rearing. The community is dominated by both grasses and forbs, and contains scattered pockets of small shrubs. Common plants in this community are typically low-growing and include species like kobresia (*Kobresia* spp.), sedges (*Carex* spp.), bluegrass (*Poa* spp.), and alpine avens (*Acomastylis rossii*) (Fitzgerald et al. 1994).

Shrublands

Shrublands dominate the WRFO Planning Area, covering 659,300 (45 percent) of the WRFO Planning Area. These communities are generally very diverse in plant composition and provide very important forage and cover to wildlife and livestock (BLM 2007b). Shrublands have been split into three vegetation communities: sagebrush, salt desert, and foothill/mountain shrub. Management actions are incorporated in the alternatives and described in more detail in Chapter 2.

Sagebrush

The sagebrush community is very large and diverse, covering more than any other community in the WRFO Planning Area at 456,600 (31 percent). This community includes vegetation associations dominated by several different subspecies of sagebrush, including Wyoming big sagebrush

(*Artemisia tridentata* subsp. *wyomingensis*), mountain big sagebrush (*Artemisia tridentata* subsp. *vaseyana*), and Basin big sagebrush (*Artemisia tridentata* subsp. *tridentata*), as well as antelope bitterbrush (*Purshia tridentata*), green rabbitbrush (*Chrysothamnus nauseosa*), and rubber rabbitbrush (*Ericameria nauseosa*). Sagebrush areas typically occur with shallow to moderately deep soils at elevations between 4,500 and 8,000 feet and 9 to 20 inches of precipitation per year (BLM 2007b).

Common grass and grass-like species found in the sagebrush community include bluebunch wheatgrass, thickspike wheatgrass (*Elymus lanceolatus*), Sandberg bluegrass, muttongrass, Indian ricegrass, needle and thread, threadleaf sedge (*Carex filifolia*), green needlegrass (*Nassella viridula*), Columbia needlegrass (*Achnatherum nelsonii*), squirreltail, and Idaho fescue. Common forbs include phlox (*Phlox* spp.), Hooker's sandwort (*Arenaria hookeri*), buckwheat, penstemon, wild onion (*Allium* spp.), Indian paintbrush (*Castilleja* spp.), globemallow (*Spheralcea* spp.), Oregon grape (*Mahonia* spp.), and prickly pear cactus (*Opuntia* spp.) (BLM 2007b).

Generally, sagebrush provides a food staple for pronghorn (*Antilocapra americana*) and sage-grouse (*Centrocercus urophasianus*) and is also one of the dominant species found on pronghorn and mule deer (*Odocoileus hemionus*) critical winter ranges (BLM 2007b). Fire is an important component of all sagebrush-dominated plant communities. Depending on the nature of the site, the fire return interval could be between 25 and 100 years (BLM 2007b).

Salt Desert

The salt desert shrubland community covers 100,400 acres (7 percent) of the WRFO Planning Area. This community is generally located between 4,500 and 6,000 feet in areas characterized by accumulations of salt on poorly developed deep soils (BLM 2007b). Soils in these areas usually have a high pH (7.8 to 9), which restricts the uptake of water by all but the most salt-tolerant plants (BLM 2007b). Forage in these areas is excellent in the winter, as these shrubs maintain relatively high levels of protein and carbohydrates.

Dominant shrubs found in this community are drought tolerant and include Gardner's saltbush (*Atriplex gardneri*), fourwing saltbush (*Atriplex canescens*), birdfoot sagebrush (*Artemisia pedatifida*), bud sagebrush (*Picrothamnus desertorum*), spiny hopsage (*Grayia spinosa*), greasewood (*Sarcobatus vermiculatus*), broom snakeweed (*Gutierrezia sarothrae*), Basin big sagebrush, rabbitbrush, and winterfat (*Krascheninnikovia lanata*) (BLM 2007b). Grasses associated with these sites are Indian ricegrass, squirreltail, Sandberg bluegrass, bluebunch wheatgrass, needle and thread, and western wheatgrass (BLM 2007b). Forbs include wild onion, biscuitroot (*Lomatium* spp.), woody aster (*Xylorhiza* spp.), globemallow, and prickly pear cactus (BLM 2007b).

Foothill/Mountain

The foothill/mountain shrub community covers 102,282 (7 percent) of the WRFO Planning Area, and is generally found between 6,500 and 7,500 feet. This community receives 10 to 14 inches of precipitation annually and provides excellent cover and browse for many species of wildlife (BLM 2007b).

Foothill/mountain shrubland includes large stands of Gambel oak and other more diverse associations with Gambel oak, mountain mahogany, mountain snowberry (*Symphoricarpos* spp.), and serviceberry (*Amelanchier* spp.), with scattered sagebrush, rabbitbrush, bitterbrush, kinnikinnik, currant (*Ribes* spp.), shrubby cinquefoil (*Dasiphora fruticosa*), and skunkbush sumac (*Rhus trilobata*). Grasses found in the community include needle and thread, basin wildrye, Indian ricegrass, green needlegrass, Columbia needlegrass, thickspike wheatgrass, Idaho fescue, Thurber's

fescue, mountain muhly, Junegrass, slender wheatgrass, Sandberg bluegrass, Kentucky bluegrass, Letterman's needlegrass, squirreltail, western wheatgrass, beardless bluebunch wheatgrass, Sandberg bluegrass, brome, and mutton bluegrass. Common forbs include arrowleaf balsamroot, buckwheat, Indian paintbrush, lupine (*Lupinus* spp.), penstemon, sego lily (*Calochortus nuttallii*), wild onion, larkspur (*Delphinium* spp.), violet (*Viola* spp.), bluebells (*Mertensia* spp.), and prickly pear cactus (BLM 2007b).

This cover type also includes a small area of shrubland that is found at or above timberline. This area consists of mostly willows (*Salix* spp.) and krummholz patches of subalpine fir. Herbaceous plants in this community are similar to those found in the subalpine/alpine grassland. These areas could be heavily used by wildlife (especially birds and small mammals) in the summer months for forage and cover, but are minimally used in the winter.

3.3.1.4 Invasive, Non-native Plant Species and Pest Control

Plants identified as invasive, non-native plant species (INPS) are invasive and not indigenous to the area. Typically, INPS are detrimental to native ecosystems and human welfare. Noxious weeds are undesirable native or non-native plants that have either been "designated" by the State of Colorado or "declared" by the county weed control districts. For the purpose of this discussion, non-native noxious weeds are a subset of INPS. With the exception of vascular plants classified as INPS, a pest could be any biological life form that poses a threat to human or ecological health and welfare.

Noxious Weeds

Plants that are INPS include those listed by the State of Colorado Department of Agriculture as noxious weeds and other species that are not formally listed as noxious, but that are very aggressive and tend to displace native plants in wildland situations. The BLM considers plants non-native if they have been introduced into an environment where they did not evolve. As a result, they usually have no natural enemies to limit their reproduction and spread (Westbrooks 1998). Invasive plant species and noxious weeds and their continued establishment represent a serious threat to the continued productivity, biological diversity, diversified use, and aesthetic value of the WRFO Planning Area (BLM 1994). Noxious weeds are defined by the Colorado Noxious Weed Act as plants that aggressively invade or are detrimental to economic crops or native plant communities; are poisonous to livestock; are carriers of detrimental insects, diseases, or parasites; or are detrimental to the environmentally sound management of natural or agricultural ecosystems (8 CCR 1203-9).

Colorado has published a list of 72 noxious weeds that may be found in the state. The species on the list have been assigned a rating of "A," "B," or "C," depending on the severity of the threat. Of these, 18 have been put on the "A" list, meaning that they are subject to eradication wherever detected. The other 54 species are either on the "B" list (discrete statewide distributions that are subject to eradication, containment, or suppression) or the "C" list (controls are recommended, but populations exist statewide).

Noxious weeds are distributed across the WRFO Planning Area. Since completion of the RMP, surface disturbing activities along with other vectors have led to the continued spread and establishment of noxious weeds.

Of the 72 species listed by the state, BLM has identified 22 noxious weed species that are present in the WRFO Planning Area and are actively being managed (Table 3-14). Management actions are

incorporated in the alternatives and described in more detail in Chapter 2. Only squarrose knapweed appears on the "A" list.

Table 3-14. WRFO Planning Area Noxious Weeds

Common Name	Scientific Name	Colorado Rating
Russian knapweed	*Acroptilon repens*	B[(1)]
Cheatgrass	*Bromus tectorum*	C[(2)]
Whitetop	*Cardaria draba*	B
Plumeless thistle	*Carduus acanthoides*	B
Musk thistle	*Carduus nutans*	B
Diffuse knapweed	*Centaurea diffusa*	B
Spotted knapweed	*Centaurea maculosa*	B
Squarrose knapweed	*Centaurea virgata*	A[(3)]
Canada thistle	*Cirsium arvense*	B
Bull thistle	*Cirsium vulgare*	B
Chinese clematis	*Clematis orientalis*	B
Poison hemlock	*Conium maculatum*	C
Houndstongue	*Cynoglossum officinale*	B
Common teasel	*Dipsacus fullonum*	B
Leafy spurge	*Euphorbia esula*	B
Black henbane	*Hyoscyamus niger*	B
Perennial pepperweed	*Lepidium latifolium*	B
Oxeye daisy	*Leucanthemum vulgare*	B
Dalmatian toadflax	*Linaria dalmatica*	B
Yellow toadflax	*Linaria vulgaris*	B
Scotch thistle	*Onopordum acanthium*	B
Common mullein	*Verbascum thapsus*	C

SOURCE: 8 CCR 1203-9.

NOTES:

[(1)]B – discrete statewide distributions that are subject to eradication, containment, or suppression

[(2)]C – controls are recommended, but populations exist statewide

[(3)]A – subject to eradication wherever detected

The BLM is also committed to immediately treating and eradicating any other Colorado "A" list noxious weeds that may be found in the WRFO Planning Area. Any additional "B" or "C" list species would be managed as opportunity is presented.

Weed Free Areas

Although much of the WRFO Planning Area contains some of the noxious weed species listed in Table 3-14, in 1996 the BLM estimated that an area covering 19 percent (497,900 acres) of the WRFO Planning Area was considered "weed free" (BLM 1996). This area covers much of the north central and northeast portions of the WRFO Planning Area. Noxious weeds are likely to have invaded some of these areas since the data were compiled. Nonetheless, particular care should be taken in these areas to avoid introducing new populations of noxious weeds. Management actions for weed free areas are incorporated in the alternatives and described in more detail in Chapter 2.

3.3.1.5 Remnant Vegetation

The WRFO Planning Area vegetation has been affected by the construction of roadways, pipelines, facilities, and infrastructure related to energy development, livestock use, noxious weed invasions, and other natural and human-caused events. As a result, few of the native vegetation communities in the WRFO Planning Area have maintained their original species composition, vegetative cover, and size.

Surveys in part of the WRFO Planning Area have revealed numerous "remnant vegetation" areas, where the integrity of the original vegetation community has remained intact. This remnant vegetation is unique and warrants additional consideration when working in these locations. These areas are important biologically and scientifically and as such the management objective is to maintain their ecological integrity. Most of these areas are in the central part of the WRFO Planning Area and encompass 3,300 acres, or less than 0.01 percent of the total area. Management actions are incorporated in the alternatives and described in more detail in Chapter 2. These areas are found in four of the six cover type groups, as shown in Table 3-15.

Table 3-15. WRFO Planning Area Remnant Vegetation

Cover Type	Acres in WRFO Planning Area	Percent of Total Remnant Vegetation
Grasslands	**45**	**1.4**
Shrublands		
Sagebrush	850	25.8
Salt Desert	83	2.5
Foothill/Mountain	300	9.1
Subtotal	**1,200**	**37.4**
Forests/Woodlands		
Pinyon/Juniper	1,300	39.4
Aspen	89	2.7
Spruce/Fir	610	18.5
Subtotal	**2,000**	**60.6**
Riparian and Wetlands	**21**	**0.6**
TOTAL	**3,300**	**100**

NOTE: If only a cover type group is listed, the available data are not detailed enough to provide the specific cover type.

For additional discussion and information about noxious weed and pest management, see the 1997 White River RMP.

3.3.2 Fish and Wildlife Resources

Fish and wildlife resources include big game, upland game, waterfowl, sage-grouse, raptors, migratory birds, small mammals, reptiles and amphibians, and fish. The BLM works closely with Colorado Parks and Wildlife to manage habitat for fish and wildlife in order to achieve and maintain suitable habitat for desired population levels and distribution within the WRFO Planning Area. Colorado Division of Wildlife is directly responsible for managing population levels, while the BLM is responsible for managing fish and wildlife habitats in a condition that would support desired levels of species. Management actions pertaining to fish and wildlife resources are incorporated in the alternatives and described in more detail in Chapter 2.

The FWS provides regulatory oversight for all species that are listed, proposed for listing, or are candidates for listing under the ESA (see Section 3.3.3.1, Federal Endangered, Threatened, Proposed and Candidate Species). The FWS also administers the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act, which protects eagles and migratory bird species whether they are hunted (e.g., waterfowl) or not (e.g., songbirds).

3.3.2.1 Wildlife

Wildlife habitats within the WRFO Planning Area consist of 2,648,100 acres of terrestrial uplands and 27,800 acres of riparian and wetland habitat. Of these totals, 1,445,700 acres of uplands and 9,500 acres of riparian and wetland habitats are managed by BLM.

Wildlife species distribution and abundance are closely tied to habitats, with some species being specialists that use a narrow range of habitats and some being generalists that occur across a broad range of habitats and conditions. Most habitats are defined by vegetation structure and composition, including forests, woodlands, tall and low shrublands, and grasslands. Non-vegetation habitats include cliffs and rock, dirt banks, barren areas, caves and mines, streams, ponds, and lakes.

The vegetation communities of the WRFO Planning Area are described in Section 3.3.1, Vegetative Communities, and the distribution of communities are illustrated in Map 3-2. Most of the central and western parts of the WRFO Planning Area consist of pinyon/juniper woodlands and sagebrush shrublands that are used as elk and deer winter range. Foothill and mountain shrub communities and forested lands provide big game summer ranges, including production habitat and summer concentration areas, at higher elevations along the Colorado-White River Divide, Danforth Hills, and Blue Mountain. Conifer forests (ponderosa pine, lodgepole pine, and spruce/fir) and aspen occur mainly in the eastern portion of the WRFO Planning Area in and near the Flat Tops Wilderness. Forest types on BLM-administered lands consist primarily of Douglas fir, aspen, and spruce/fir stands adjacent to the White River National Forest and along the White-Colorado River divide. Salt desert shrub and low elevation grasslands provide habitat for species such as white-tailed prairie dog and pronghorn, and occur along U.S. 40 and in the Coal Oil Basin near Rangely. Agricultural meadows occur mostly near Meeker and along the White River and Piceance Creek.

A land health assessment has been performed for the Wolf Creek Watershed – Three Springs Ranch (BLM 2004b). This is an area of 107,800 total acres, 82,200 acres of which is BLM-managed land, located between Dinosaur National Monument and the White River. Approximately 95 percent of the area is achieving or moving toward achieving the public land health standard for animal communities. Areas not achieving the standard have been adversely affected by historical grazing practices, historical feeding practices, and use near water. The majority of the early seral areas that do not meet the standard are dominated by cheatgrass. These conditions are generally representative of the WRFO Planning Area.

Colorado Division of Wildlife (CDOW 2006) and BLM share concerns related to habitats for big game and other species. Due largely to the long-term absence of fire effects, woodland and shrubland communities are increasingly represented by advanced ecological states where declining herbaceous production and vigor are the norm. Woodland stands have tended to increase in canopy density, with young trees advancing into former fire-induced disclimax shrublands. Particularly in drainage bottoms, lower elevation basins, and mid-elevation ridgelines, the density and composition of grass/forb understories are below potential and these sites are frequently heavily colonized, if not dominated, by invasive annual grasses and forbs.

In particular, deciduous browse species beneath woodland canopies on Piceance Basin's lower elevation winter ranges generally display low vigor and production due to excessive browsing. Pinyon pine is aggressively colonizing several thousands of acres of mountain shrub and mountain big sagebrush communities on the southern rim of the Basin between 7,200 and 7,800 feet. Similarly, there is heavy local utilization of Wyoming big sagebrush, black sagebrush, and rubber rabbitbrush during the late winter and early spring in the Douglas Creek drainage. Localized die-offs of Wyoming big sagebrush have occurred in GMU 21 (Douglas Creek area, described below). This mortality has likely been prompted by extended drought and aged plants, but represents a somewhat protracted reduction in the winter forage base for deer and elk. These habitat issues are attributed to a number of factors, including: plant succession toward late seral or climax communities, historic livestock grazing practices, locally heavy big game use, increasing elk populations since the late 1970s, fire suppression, the proliferation of invasive weeds, overall reductions in big game and livestock grazing use, and altered distribution of big game in response to private lands where hunting does not occur.

Big Game Species

The WRFO Planning Area includes all or nearly all of five CPW GMUs, including GMUs 21, 22, 23, 24, and 10, and portions of several other GMUs (Map 3-4, Map 3-5, Map 3-6, and Map 3-7). CPW manages big game species by herd units defined as Data Analysis Units (DAUs), which are comprised of one or more GMUs. Population objectives are set for each DAU and are monitored by CPW.

Elk

Three populations of elk (*Cervus elaphus*) occur in the WRFO Planning Area: the Blue Mountain herd, Yellow Creek herd, and White River herd (Table 3-16). The White River herd is the largest of the three elk herds, with an estimated population of 38,000 elk.

Table 3-16. Elk Herd Populations

Data Analysis Unit (DAU)	Current Population Estimate	CPW Population Objective
E-10 -Yellow Creek	8,300	7,000-9,000
E-6 -White River	38,000	32,000-39,000
E-21 - Blue Mountain	3,200	1,200

SOURCE: CDOW data, 2006.

The White River herd (DAU E-6) occurs primarily in GMUs 23 and 24, which are east of SH 13 between Rifle and Meeker. This herd summers primarily on the White River National Forest (Map 3-6), in habitats ranging from sagebrush to subalpine/alpine grassland. Relatively small or isolated tracts of BLM-administered lands with aspen and foothill/mountain shrubland also provide summer range in the Danforth Hills, Oak Ridge and Nine Mile Gap areas. Winter range is confined (Map 3-7), and includes the benchlands along the White River and its major tributaries, extending south along the Grand Hogback and north to Nine Mile Gap and Milk Creek. These areas include both winter concentration areas and severe winter range, and consist of mostly Gambel oak, sagebrush and agricultural lands. The Oak Ridge State Wildlife Area southeast of Meeker, administered by CPW, contains about 3,000 acres of BLM land. This is a major winter concentration area that supports about 2,000 elk from December through April.

The Yellow Creek herd (DAU E-21) summers along the Piceance Rim and Roan Plateau, and west into Utah, in the southern parts of GMUs 21 and 22, and the northern edge of GMUs 31 and 32. Foothill and mountain shrub communities and forested lands provide big game summer ranges,

including production habitat and summer concentration areas, at higher elevations along the Colorado-White River divide, Danforth Hills, and Blue Mountain. Due to its limited extent, summer range is considered critical (Map 3-6). About 70 percent of this herd winters in the Douglas and Piceance Creek Basins, where winter concentration areas are present. About half of SH 139 between Douglas Pass and Rangely is identified as highway crossing areas, where there are problems with vehicle collisions.

The Blue Mountain herd (DAU E-21) summers on Blue Mountain and east to the Citadel Plateau, in the north half of GMU 10, north of U.S. 40. Due to their limited extent, summer ranges are considered critical habitat, especially aspen. CPW identifies much of the area around Blue Mountain as a summer concentration area, and elk production areas are also present. Critical summer ranges consist mostly of mountain shrub and higher elevation sagebrush. The Blue Mountain herd winters in lower elevation juniper and sagebrush, with significant concentrations in Lower Wolf Creek, Crooked Wash, and Dinosaur National Monument, which are mapped by CPW as winter concentration and severe winter range (Map 3-7). All of U.S. 40 and portions of SH 64 and the road from Blue Mountain to Rangely are identified as highway crossing areas, where there are problems with collisions between elk and vehicles.

The Yellow Creek and White River herds have current populations that are within CPW's population objectives, while the Blue Mountain herd is substantially larger than CPW's objective. Elk production areas, movement corridors and severe winter range are considered critical habitat in all herd units, and summer range is considered critical for the Yellow Creek and Blue Mountain herds.

Mule Deer

There are three general herds of mule deer in the WRFO Planning Area, the Rangely (Blue Mountain) herd, the Douglas Pass (Bookcliff) Herd, and the White River (Piceance Basin) herd.

The White River herd (identified in the 1997 White River RMP as Piceance Basin herd) (DAU D-7) is the largest, with an estimated population of more than 100,000 deer (see Table 3-17). It summers on the White River National Forest and the Roan Plateau, and winters in the Piceance Basin. Summer range includes higher elevation pinyon/juniper and sagebrush, as well as aspen, mountain shrub, and other higher elevation habitats (Map 3-4). Winter ranges consist largely of lower elevation pinyon/juniper woodlands and sagebrush. Winter concentration areas are located along the White River and around Meeker, and severe winter range occupies the lower Piceance Basin (Map 3-5).

The Rangely (Blue Mountain) herd (DAU D-6) summers on Blue Mountain, and winters on benches along the White and Yampa Rivers and the south face of Blue Mountain, mostly in GMU 10. Winter concentration areas and severe winter range are located along and south of U.S. 40, to the White River east of Rangely.

The Douglas Pass (Bookcliff) herd (DAU-11) occurs mostly in GMU 21. The herd summers on the Colorado/White River divide (Map 3-4). Suitable summer habitat is confined to a portion of the Cathedral Bluffs, the Baxter/Douglas Pass divide, and isolated tracts on Oil Spring, Rabbit and Texas Mountains. About 60 percent of the population winters at lower elevations in the Douglas, Missouri, and Evacuation Creek drainages. Winter concentration and severe winter areas are located along the White River and in the Douglas Creek Basin.

The population of the White River herd is substantially larger than the CPW population objective, while the much smaller Rangely and Douglas Pass herds are near population objectives. Mule deer production areas, movement corridors and severe winter range are considered critical habitat by CPW for mule deer in all GMUs.

Table 3-17. Mule Deer Populations

Data Analysis Unit (DAU)	Current Population Estimate	CPW Population Objective
D-6 – Rangely	8,000	7,000
D-7 – White River	106,000	67,500
D-11 – Douglas Pass	9,800	10,000-12,000

SOURCE: CDOW data, 2006.

Pronghorn

Pronghorn occur in the northwestern portion of the WRFO Planning Area, primarily between Pinyon Ridge and the Colorado-Utah state line, mostly in GMU 10 (Table 3-18 and Map 3-8). Overall range consists primarily of salt desert and sagebrush shrublands and lowland grassland.

Table 3-18. Pronghorn Populations

Data Analysis Unit (DAU)	Current Population Estimate	CDOW Population Objective
A-10 – Maybell	1,200	1,400
A-21 – Dinosaur	400	300

SOURCE: CDOW data, 2006.

The Dinosaur herd unit (DAU A-21) currently supports 400 animals, while CPW's long-term goals call for an average post-season herd of 300 animals. All occupied habitat in the Dinosaur herd unit is identified by CPW as "overall range," except for a resident population northwest of Rangely in the Coal Oil Basin. The general distribution shifts toward the west in winter, but no identified areas of winter range are present. A small area of pronghorn overall range is also present in the northern part of GMU 21, adjacent to pronghorn overall range and resident population areas near Rangely.

The Maybell herd unit (DAU A-10) mostly occurs north of the WRFO Planning Area. Small areas of overall range and winter range occur in the WRFO Planning Area near Elk Springs and Crooked Wash. Habitats include sagebrush and rangeland/lowland grassland. The number of pronghorn in Elk Springs and Crooked Wash area normally does not exceed 40 or 50 animals.

Other Key Mammal Species

Black Bear

Black bear (*Ursus americanus*) regularly occur in about two-thirds of the WRFO Planning Area, including the higher elevations in the Douglas Creek and Piceance Creek drainages, the upper White River, Danforth Hills, and portions of the Blue Mountain area. Summer concentration areas occur in portions of the Danforth Hills and White River National Forest. Fall concentration areas occur on the Baxter Pass/Douglas Pass divide and Roan Plateau (NDIS 2006). Concentration area habitats include aspen, mountain shrub, higher elevation sagebrush, and Douglas fir. The WRFO has not developed specific bear management objectives, but manages their habitat integral with big game habitat.

Mountain Lion
The entire WRFO Planning Area is within the overall range of mountain lion (*Felix concolor*), which occur in all habitats. No areas of human conflict have been identified by CPW (NDIS 2006). Their seasonal movements largely follow those of mule deer, their main prey. The WRFO has not developed specific lion management objectives, but manages their habitat integral with big game habitat.

White-tailed Prairie Dog
White-tailed prairie dog (*Cynomys leucurus*) towns occur primarily in the salt desert shrubland and rangeland/low grassland along U.S. 40 from Pinyon Ridge to the Utah border, in the Coal Oil Basin northwest of Rangely, and in the Crooked Wash area. The white-tailed prairie dog is a BLM-sensitive species, and their towns provide habitat for black-footed ferret (*Mustela nigripes*) and burrowing owl (*Athene cunicularia*), special status species discussed in more detail in Special Status Species below (Section 3.3.3).

Birds

Turkey
Turkey (*Meleagris gallopavo*) were not addressed in the 1997 White River RMP, but reintroduced populations have since become established in the WRFO Planning Area. They inhabit mountain shrub, pinyon/juniper, ponderosa pine, and mixed conifer habitats. Turkey overall range occurs along the Roan Plateau, Baxter Pass/Douglas Pass divide, and upper White River Valley. Winter range and a winter concentration area are located in the White River Valley above Meeker, and a second area of winter range is located in the East Douglas Creek/Cathedral Creek area. The WRFO has not developed specific turkey management objectives, but manages their habitat integral with big game and grouse habitat.

Dusky Grouse
Dusky grouse (*Dendragapus obscurus*), (formerly known as blue grouse) are relatively common and widely distributed in mixed and mountain shrub, aspen, and coniferous forest habitats above 7,200 feet in the WRFO Planning Area. The BLM administers approximately 405,600 acres of dusky grouse habitat in the resource area. Population statistics show that dusky grouse populations are stable, although significant periodic swings in abundance occur due to environmental effects on annual recruitment. Blue Mountain and Piceance Basin/Roan Plateau are the two most important dusky grouse areas in terms of recreation use and abundance (BLM 2007b).

Greater Sage-Grouse
On March 5, 2010, the FWS concluded that the greater sage-grouse warranted listing as an endangered species under the Endangered Species Act, but that listing was precluded by the need to complete listing actions of higher priority. Range-wide, this species is considered a candidate for listing – a designation that affords management attention equivalent to that of species considered "sensitive" by the BLM. Sage-grouse are considered special status because of large-scale reductions in suitable sagebrush habitats, substantial declines in continental populations, and the near obligate relationship between these birds and sagebrush. A 2008 Colorado Greater Sage-Grouse Conservation Plan, and two local conservation plans that address the northwestern Colorado population in Moffat and Rio Blanco counties, and the PPR population in Rio Blanco and Garfield counties have been completed.

Sage-grouse are known for their strong association with sagebrush habitat. However, they require a diversity of habitats during the year, and may travel long distances between seasonal ranges,

depending on their availability. Breeding habitat includes leks (communal breeding sites), nesting areas, and early brood-rearing habitat that is used from about mid-March to mid-July. Leks are generally traditional, and consist of flat, open areas surrounded by sagebrush with more than 20 percent cover, in the vicinity of nesting habitat. Nesting and early brood-rearing habitats are similar, and include appropriate sagebrush canopy cover of 10 to 25 percent with greater than 15 percent herbaceous ground cover. Young birds eat insects for their first three weeks and mostly forbs until they are three months old. As the sagebrush habitat stands begin to dry out in mid-summer, sage-grouse move to more mesic areas, including higher elevations, wet meadows, and riparian areas where succulent forbs are present. From mid-September into November, sage-grouse prefer areas with relatively dense canopy cover and late green forbs. Winter habitat generally has sagebrush greater than 12 to 16 inches tall and greater than 25 percent canopy cover in drainages with tall sagebrush and on ridges and south and west-facing slopes. Winter habitat is used by segregated flocks of males and females.

Sage-grouse are scattered through the non-forested parts of the WRFO Planning Area, with the largest populations on the Piceance Rim/Roan Plateau and on Blue Mountain (Map 3-10). Blue Mountain supports the largest and most productive population and has the largest contiguous block of suitable habitat in the resource area. Most of the breeding and nest activities occur on Turner and Wolf Creeks. Blue Mountain's capacity for strong production and recruitment is largely attributable to an abundance of wet meadow habitats. In the Piceance Basin/Roan Plateau area, virtually all seasonal use functions take place on relatively narrow mid-elevation ridges. The Piceance population appears to have undergone a substantial decline since the 1980s, which may be related to the advanced successional status of the mountain shrub and sagebrush communities. The remaining habitat complexes are characterized by suboptimal or fragmented habitats that support low breeding densities. However, areas such as Wolf Creek and Crooked Wash have been documented to support hundreds of wintering birds (BLM 2007b).

Approximately 115 leks have been identified in the WRFO Planning Area, of which about 25 are currently active. The status of about 20 leks is unknown, because of limited or irregular use. The count of males at leks in the WRFO Planning Area in 2006 was 646 birds, and although the highest total since 1989, is a figure that cannot be used as an accurate indicator of trend because of differences in survey effort. Until recently, it was believed that the majority of grouse nesting occurred within two miles of an associated lek, and it followed that sage-grouse production areas were described as suitable nest habitat within two miles of active leks. Based on newer telemetry data, it is currently accepted that 80 percent of nesting occurs within a four-mile radius of a lek. Particularly for the PPR population, only a small portion of the production area is suitable for nesting. Threats to greater sage-grouse include loss and degradation of habitat, including changes due to fire, invasive plant species, energy development, grazing, and fragmentation (Colorado Greater Sage-Grouse Steering Committee 2008).

Columbian Sharp-Tailed Grouse

Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbiana*) are considered species of special concern and are discussed below under Special Status Species (Section 3.3.3).

Raptors

Raptors include eagles, falcons, owls, and hawks. Because they are at the top of food chains and are present in fewer numbers than their prey, they serve as important indicators of overall ecosystem health. Several species are designated as BLM-sensitive or State of Colorado species of special concern, which conveys special management status to these species. In addition, active nests of all species of raptors are protected under the Migratory Bird Treaty Act, and bald (*Haliaeetus*

leucocephalus) and golden eagles (*Aquila chrysaetos*) are protected under the BGEPA. The WRFO requires nest surveys for projects potentially affecting nesting habitat, and maintains a database of raptor nest locations. Current WRFO management focuses on protecting raptor nesting efforts and maintaining the integrity of nesting habitat.

Table 3-19 summarizes raptor occurrence in the WRFO Planning Area (based on Righter et al. 2004 and the BLM databases for historic and recent raptor nests). Twenty-one species of raptors occur in the WRFO Planning Area at least occasionally, of which 20 are known or suspected to breed. Of these, 15 species of raptors have been reported to nest on BLM-administered land. The most common species on BLM-administered land include red-tailed hawk (*Buteo jamaicensis*), golden eagle, ferruginous hawk (*Buteo regalis*), Cooper's hawk (*Accipiter cooperii*), and great-horned owl (*Bubo virginianus*). Nest records are more comprehensive for species that build large conspicuous cliff nests, while species that are inconspicuous and nest in trees or cavities could be under represented.

Land use practices over the past 25 years or more generally favor species that forage over open country, but may be reducing the availability of suitable habitat for species that nest in woodlands, such as accipiters (Cooper's hawk, sharp-shinned hawk [*Accipiter striatus*], and northern goshawk [*Accipiter gentilis*]). The less common woodland habitats, including spruce fir, aspen and riparian, are relatively small and dispersed but have very high breeding densities.

Bald eagles are considered species of special concern and are discussed below under Special Status Species (Section 3.3.3).

Table 3-19. Raptor Species and Habitats

Species	Scientific Name	Residency Status	Breeding in WRFO Planning Area/ Recorded to Nest on BLM(1)	Nesting Habitat	Special Status
Turkey vulture	*Cathartes aura*	Common summer resident, migrant	BR/--	Cliffs and riparian areas	--
Osprey	*Pandion haliaetus*	Uncommon migrant and rare summer resident	BR/--	Riverine cottonwood	--
Bald eagle	*Haliaeetus leucocephalus*	Fairly common summer resident, fairly common winter resident	BR/--	Riverine cottonwood and ponderosa pine	Federal Protected, State threatened
Northern harrier	*Circus cyaneus*	Uncommon summer resident and common migrant	BR/BLM	Wetlands, grasslands, sagebrush	--
Sharp-shinned hawk	*Accipiter striatus*	Fairly common summer resident, migrant and winter resident	BR/BLM	Douglas fir, spruce fir, pinyon/juniper	--
Cooper's hawk	*Accipiter cooperii*	Fairly common summer resident, migrant and winter resident	BR/BLM	Riparian areas, conifers, pinyon/ juniper	--
Northern goshawk	*Accipiter gentilis*	Uncommon permanent resident	BR/BLM	Mature coniferous and aspen forests over 6,500 feet	BLM sensitive

Table 3-19. Raptor Species and Habitats

Species	Scientific Name	Residency Status	Breeding in WRFO Planning Area/ Recorded to Nest on BLM(1)	Nesting Habitat	Special Status
Swainson's hawk	*Buteo swainsoni*	Uncommon summer resident, uncommon migrant	BR/--	Gambel oak, trees in or adjacent to open country, all elevations	--
Red-tailed hawk	*Buteo jamaicensis*	Common summer resident, migrant and winter resident	BR/BLM	Cliffs and forested areas, all habitats	--
Ferruginous hawk	*Buteo regalis*	Uncommon summer resident, uncommon migrant and rare winter resident	BR/BLM	Isolated junipers in desert or sagebrush	BLM sensitive, state special concern
Rough-legged hawk	*Buteo lagopus*	Fairly common winter resident	--	NA	--
Golden eagle	*Aquila chrysaetos*	Fairly common resident	BR/BLM	Cliffs, occasionally in cottonwoods, Douglas-fir	Federal Protected
American kestrel	*Falco sparverius*	Common resident and migrant	BR/BLM	Cavities including trees, nest boxes, magpie nests, holes cliffs, all habitats	--
Merlin	*Falco columbarius*	Rare migrant and winter resident	--	NA	--
Peregrine falcon	*Falco peregrinus anatum*	Uncommon summer resident, rare migrant	BR/--	Cliffs near water	State special concern
Prairie falcon	*Falco mexicanus*	Uncommon permanent resident	BR/BLM	Cliffs adjacent to open country	--
Flammulated owl	*Otus flammeolus*	Fairly common summer resident	BR/--	Conifer forest, aspen, above 7,000 feet	--
Barn owl	*Tyto alba*	Rare permanent resident	BR/--	Lowland agricultural areas, roosts in buildings and trees	--
Western screech-owl	*Megascops kennicottii*	No known records	BR/--	Cottonwoods in riparian, urban, and rural areas, possibly pinyon/ juniper	--
Great-horned owl	*Bubo virginianus*	Fairly common permanent resident	BR/BLM	Riparian areas, hawk nests, ledges, all habitat	--
Snowy owl	*Nyctea scandiaca*	Casual winter visitor	--	NA	--
Northern pygmy owl	*Glaucidium gnoma*	Uncommon permanent resident	BR/BLM	Aspen, dense pinyon/ juniper	--
Burrowing owl	*Athene cunicularia*	Uncommon summer resident	BR/BLM	Prairie dog towns	State threatened

Table 3-19. Raptor Species and Habitats

Species	Scientific Name	Residency Status	Breeding in WRFO Planning Area/ Recorded to Nest on BLM(1)	Nesting Habitat	Special Status
Long-eared owl	*Asio otus*	Uncommon summer and winter resident	BR/BLM	Pinyon/juniper woodlands, woody riparian growth, often occupy magpie nests	--
Short-eared owl	*Asio flammeus*	Rare migrant and winter visitor	--	NA	--
Boreal owl	*Aegolius funereus*	Uncommon permanent resident	BR (Flat Tops)/--	Mature and old-growth spruce fir forest	--
Northern saw-whet owl	*Aegolius acadicus*	Common summer resident and migrant, uncommon winter resident	BR/BLM	All forest types	--

SOURCE: Righter et al. 2004 and the BLM databases.

NOTES:

(1) BR – breeding in WRFO Planning Area

BLM – recorded breeding on BLM-administered lands

NA = not applicable

Other Important Bird Species

More than 200 species of nongame birds, including neotropical migratory species, have been documented in the WRFO Planning Area, of which 60 percent are breeding or resident species. Many of the more uncommon breeding species are associated with riparian, wetland, or aquatic habitats, or other habitats such as aspen or spruce fir that are of limited extent on BLM lands in the WRFO Planning Area, but are common within the region. Species that occur in pinyon/juniper and sagebrush, such as juniper titmouse (*Baeolophus ridgwayi*) and gray flycatcher (*Empidonax wrightii*), are common in the WRFO Planning Area but have restricted continental distributions.

Table 3-20, provides a list of bird species present in the WRFO Planning Area that have been identified as being of conservation concern. The FWS compiled a list of Birds of Conservation Concern to identify migratory and non-migratory bird species that, without conservation actions, may become candidates for listing under the ESA (FWS 2002). The species listed below occur in the WRFO Planning Area and appear in the FWS Migratory Bird Program Strategic Plan 2004-2014 as birds of conservation concern for Region 16 (Southern Rocky Mountains/Colorado Plateau) and Region 6 (Mountain-Prairie Region). Species that are addressed in more detail in Section 3.3.3, Special Status Species, are shown in italics.

Table 3-20. Other Important Bird Species

Species	Scientific Name	Habitat Affiliation	Distribution	Estimated Miles^2 of Potential Habitat (BLM-administered)	Abundance[1]
Breeding Species					
Mountain plover	*Charadrius montanus*	Wyoming big sagebrush	1 historic site	5	Rare, peripheral
Wilson's phalarope	*Phalaropus tricolor*	Persistent ponds	Localized	NA	Uncommon
Band-tailed pigeon	*Columba fasciata*	Gambel oak, ponderosa pine	Localized	18	Uncommon
Yellow-billed cuckoo[2]	*Coccyzus americanus*	Major: Riverine riparian. Minor: Urban deciduous	1 historic report	1	Rare
Lewis's woodpecker	*Melanerpes lewis*	Mature ponderosa pine, Gambel oak, cottonwood riparian	Localized	5	Uncommon
Williamson's sapsucker	*Sphyrapicus thyroideus*	Major: mature pinyon/ juniper, Douglas-fir, spruce-fir, aspen, Minor: cottonwood	Widespread	300	Uncommon
Red-naped sapsucker	*Sphyrapicus nuchalis*	Major: aspen. Minor: urban deciduous	Widespread	10	Fairly common
Olive-sided flycatcher	*Contopus cooperi*	Major: Douglas fir and spruce fir. Minor: riverine cottonwood	Widespread	50	Fairly common
Loggerhead shrike	*Lanius ludovicianus*	Major: Wyoming and basin big sagebrush, greasewood in saltbush matrix. Minor: Utah juniper/Wyoming big sagebrush	Localized	275	Fairly common
Gray vireo	*Vireo vicinior*	Utah juniper/black and Wyoming big sagebrush	Localized	150	Fairly common
Pinyon jay	*Gymnorhinus cyanocephalus*	Pinyon/juniper woodlands	Widespread	1,000	Common
Virginia's warbler	*Vermivora virginiae*	Major: mountain shrub. Minor: woody riparian, pinyon/ juniper	Widespread	450	Common
Black-throated gray warbler	*Dendroica nigrescens*	Pinyon/juniper woodlands	Widespread	1,000	Abundant
Brewer's sparrow[2]	*Spizella breweri*	Big sagebrush, saltbush	Widespread	600	Common to Abundant
Sage sparrow	*Amphispiza belli*	Saltbush, Wyoming big sagebrush	Localized	200	Common

Table 3-20. Other Important Bird Species

Species	Scientific Name	Habitat Affiliation	Distribution	Estimated Miles² of Potential Habitat (BLM-administered)	Abundance[1]
Lark bunting	*Calamospiza melanocorys*	Mid-elevation Wyoming big sagebrush	Localized	50	Erratic, absent to uncommon
Strict Migrants (No Evidence of Breeding)					
Snowy plover	*Chardarius alexandrinus nivosus*	Rio Blanco Lake SWA[3]	--	--	Uncommon
American avocet	*Recurvirostra americana*	Larger reservoirs and stockponds	--	--	Fairly common
Solitary sandpiper	*Tringa solitaria*	Widely scattered reservoirs, stock-tanks, beaver ponds	--	--	Uncommon
Willet	*Catoptrophorus semipalmatus*	Larger reservoirs and stockponds	--	--	Common
Upland sandpiper	*Bartramia longicauda*	Hayland, high-elevation grassland	--	--	2 records
Long-billed curlew[2]	*Numenius americanus*	Rio Blanco Lake SWA, Piceance Creek, Wolf Creek, Coyote Basin	--	--	Rare
Marbled godwit	*Limosa fedoa*	Rio Blanco Lake SWA	--	--	Fairly common
Sanderling	*Calidris alba*	Rio Blanco Lake SWA	--	--	Rare
White-rumped sandpiper	*Calidris fuscicollis*	Rio Blanco Lake SWA	--	--	Rare
Caspian tern	*Sterna caspia*	Rio Blanco Lake SWA, Kenney Reservoir	--	--	Rare
Short-eared owl	*Asio flammeus*	Cathedral Bluffs, Wolf Creek, Rio Blanco SWA	--	--	Rare
Black swift	*Cypseloides niger*	No records from BLM	--	--	NA
Rufous hummingbird	*Selasphorus rufus*	Widespread	--	--	Common
Bell's vireo	*Vireo bellii*	Lower White River valley	Peripheral	--	1 record
Bendire's thrasher	*Toxostoma bendirei*	White River valley	Peripheral	--	1 record

Table 3-20. Other Important Bird Species

Species	Scientific Name	Habitat Affiliation	Distribution	Estimated Miles^2 of Potential Habitat (BLM-administered)	Abundance[(1)]
Blackpoll warbler	*Dendroica striata*	White River valley	--	--	Rare
McCown's longspur	*Calcarius mccownii*	Little Beaver Creek, Wolf Creek	--	--	Rare
Chestnut-collared longspur	*Calcarius ornatus*	Piceance Basin (1970s record, no details)	--	--	NA

SOURCE: Combination of BLM data and Birds of Western Colorado Plateau and Mesa Country (Robert Righter, Rich Levad, Coen Dexter, and Kim Potter). 2004.

NOTES:

(1) Abundance:

Breeding: abundant – always encountered in number; common – always encountered in lesser numbers; fairly common –usually encountered in lesser numbers; uncommon – infrequently encountered on annual basis; rare – less than 3 breeding pairs or only encountered on decade basis.

Migration: abundant – encountered daily in number; common – encountered daily in less number; fairly common – consistently recorded on annual basis; uncommon – recorded most years in very small numbers (<10); rare – recorded only infrequently on decade basis.

(2) Species discussed in detail in the Special Status Species section.

(3) SWA = State Wildlife Area

Other Nongame Species

Based on CPW records, 47 species of nongame mammals, 6 amphibian species, and 14 reptiles are known or suspected to occur as seasonal or permanent residents. The status of small mammals associated with the pinyon/juniper and sagebrush habitat in the Piceance Basin has been documented in a limited sense through oil shale baseline studies from the 1970s and 1980s. The status of other groups, such as bats, reptiles, and amphibians, are poorly documented.

3.3.2.2 Fish

Aquatic Habitat

Several lakes are present along or near the White River in the WRFO Planning Area, including Trappers Lake, Lake Avery, Rio Blanco Lake, and Kenney Reservoir, but are not managed by BLM. The only BLM-administered pond or lake fisheries are small and comprise intermittent or marginal fish habitat. They include Divide Creek Reservoir, a 5-acre pond that has supported black bullhead and channel catfish, and Peterson Draw Reservoir, a 2-acre impoundment stocked intermittently with rainbow trout.

The BLM manages portions of 80 perennial stream systems in the WRFO Planning Area, of which 21 are known to support nongame and sport fish (Table 3-21 and Map 3-3). Including the White River, the BLM administers about 107 miles of stream fisheries. Many BLM-administered reaches consist primarily of small perennial headwater reaches in the Piceance and Douglas Creek areas. Most of these streams have few fish species present and are rated as fair condition, with a trend of static or improving. With few exceptions, fish abundance and distribution is limited by marginal or fluctuating flows and/or degraded stream conditions. Limitations present for these habitats include

low flow, lack of woody vegetation, and high sediment. In addition, BLM manages only short, discontinuous reaches on most of these streams.

The BLM manages about 22.4 miles of the lower White River and 3.6 miles of the upper White River and North Fork of the White River. These rivers have a greater diversity of fish species than most of the streams on BLM-managed lands, including more game fish, and are in fair to good condition (BLM 2007b). Many BLM-managed segments are short and isolated, making effective management problematic. The other major river in the region, the Yampa River, occurs on the north edge of the WRFO Planning Area but is entirely within Dinosaur National Monument.

Table 3-21. Stream Fish Habitats Managed by BLM

Geographic Reference Area/ Streams	Total Length on BLM-Administered Lands (miles)	Cumulative Length of BLM Reaches (over 0.25 mile) (miles)	Fishery Type	Condition and Trend	Problems/ Limitations
Danforth Hills/Jensen					
Big Beaver Creek	0. 7	0.7	Cutthroat trout	Good	Recognized strain of Colorado River cutthroat trout
Piceance					
Black Sulphur Creek	3.6	3.4	Cutthroat trout, mountain sucker, speckled dace, rainbow trout	Fair-static	High sediment, limited flow
East Willow Creek	2.2	2.0	Rainbow trout	Fair-static	Low flow, woody expression
Fawn Creek	1.2	1.0	Brook trout, mountain sucker, speckled dace	Fair-static	Woody expression, limited flow
Piceance Creek	6.1	4.7	Speckled dace, rainbow trout, brook trout, mountain sucker, flannelmouth sucker	Fair-static	Short and isolated reaches, woody expression, irrigation drawdowns
Willow Creek	1.0	0.4	Speckled dace, rainbow trout, brook trout, mountain sucker	Fair-static	Short, isolated reaches; wood expression
Yellow Creek	6.0	6.0	Speckled dace, mountain sucker	Fair-static in upper, decline in lower	High salinity
Douglas/Cathedral					
Bear Park Creek	1.9	1.7	Speckled dace, cutthroat trout	Fair-improve	Woody expression, limited flow
Bitter Creek	1.9	1.9	Brook trout, cutthroat trout	Fair-static	Woody expression
Brush Creek	0.2	0	Rainbow trout	Fair-static	Woody expression; bank stability; short, isolated reaches

Table 3-21. Stream Fish Habitats Managed by BLM

Geographic Reference Area/ Streams	Total Length on BLM-Administered Lands (miles)	Cumulative Length of BLM Reaches (over 0.25 mile) (miles)	Fishery Type	Condition and Trend	Problems/ Limitations
Cathedral Creek	2.5	2.0	Cutthroat trout	Fair-improve	Irrigation drawdown, recognized strain of Colorado River cutthroat trout
Douglas Creek	23.5	23.0	Speckled dace	Fair-improve	Heavy sediment, intermittent flow
East Douglas Creek	15.2	14.6	Brook trout, cutthroat trout, speckled dace	Fair-static	Channel barriers from large beaver dams, high sediment
Lake Creek	2.8	2.8	Cutthroat trout	Fair-static	Woody expression, recognized strain of Colorado River cutthroat trout
Right Fork of Lake Creek	1.1	1.1	Cutthroat trout	Fair-static	Mass wasting, recognized strain of Colorado River cutthroat trout
Soldier Creek	2.1	2.1	Cutthroat trout, brook trout	Fair-static	Mass wasting, recognized strain of Colorado River cutthroat trout
West Douglas Creek	7.2	7.2	Speckled dace	Fair-static	Heavy sediment, intermittent flow
White River					
Lower White River	22.4	14.3	Mountain whitefish, roundtail chub, Colorado pikeminnow, speckled dace, bluehead sucker, flannelmouth sucker, mottled sculpin, rainbow trout, channel catfish, black bullhead	Fair/good-static	Bank stability (Tamarisk and Russian olive infestations), flow modification, short and isolated stretches
North Fork White River	1.6	0	Rainbow trout, brook trout, brown trout, mountain whitefish, cutthroat trout, mountain sucker	Good-static	Short, isolated reaches
Upper White River	2.0	0.3	Brown trout, rainbow trout, mountain sucker, mountain whitefish, bluehead sucker, flannelmouth sucker, speckled dace	Fair/good-static	Short, isolated reaches
Crooked Wash/Deep Channel					
Crooked Wash	2.4	2.3	Speckled dace, mountain sucker	Poor-static	Intermittent flow, limited site capability

Key Aquatic Species

The primary cold water game fish species are trout, including cutthroat (*Oncorhynchus clarki*), rainbow (*Oncorhynchus mykiss*), brook (*Salvelinus fontinalis*), and brown trout (*Salmo trutta*). Mountain whitefish are also present in the upper White River and North Fork of the White River. Warm water game fish species include northern pike (*Esox lucius*), yellow perch (*Perca flavescens*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and black bullhead (*Ameiurus melas*), which are present primarily in a 100-acre off-channel reservoir along the White River (Rio Blanco Lake State Wildlife Area) and in Kenney Reservoir (a 400-acre impoundment on the White River). Channel catfish (*Ictalurus punctatus*) and black bullhead are present in the lower White River.

Non-game fish species include native species such as speckled dace (*Rhinichthys osculus*), bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), and mottled sculpin (*Cottus bairdi*), and non-natives such as common carp (*Cyprinus carpio*), red shiner (*Cyprinella lutrensis*), fathead minnow (*Pimephales promelas*), and plains topminnow (*Fundulus sciaticus*). Speckled dace are the most widely distributed native non-game fish, occurring regularly in most perennial streams. The other native fish occur primarily in the White River and its larger tributaries. Populations of non-native fish are stable, except below Taylor Draw Dam. Native fish populations dominated the White River drainage prior to closure of Taylor Draw Dam in 1984. Since then, non-native fish including red shiner, fathead minnow, and to a lesser extent common carp and predatory game fish, are common in the lower White River (BLM 2007b).

3.3.3 Special Status Species - Animals

Special status species are those species with populations that have declined to the point of substantial federal or state agency concern. Special status species are listed by the FWS under the federal ESA; species listed as endangered, threatened or special concern by the CPW; and those placed on the Colorado BLM State Director's Sensitive Species List. Federal threatened and endangered species and designated critical habitat are managed in cooperation with the FWS and other federal agencies, in support of recovery. For listed species that have not had critical habitat identified and designated, BLM cooperates with the FWS and CPW to determine and manage habitats to support the species. Candidate species are managed to maintain viable populations, thereby preventing federal listing from occurring. State of Colorado and BLM sensitive species are treated similarly. The BLM, FWS, and the State of Colorado have developed formal and informal agreements to provide guidance on the management of species. Consultation is required on any action proposed by the BLM or another federal agency that may affect a listed, proposed, or candidate species or result in jeopardy or modifications of critical habitat.

3.3.3.1 Federal Endangered, Threatened, Proposed and Candidate Animal Species

There are 10 federally listed animal species that may occur in the WRFO Planning Area, including 2 candidates for federal listing (Table 3-22). Six endangered or threatened animal species are known to occur in the WRFO Planning Area, including black-footed ferret, Canada lynx (*Lynx canadensis*), and four Colorado River fish species. Critical habitat for the four fish species is present in the WRFO Planning Area. The only threatened or endangered animals that make consistent use on BLM land include black-footed ferret and Colorado pikeminnow (*Ptychocheilus lucius*). The presence of black-footed ferret is associated with a reintroduction program.

Increasing industrial development in the WRFO Planning Area could increase pressure on some federally listed and candidate species and their habitats. Since these species are protected under the

ESA, federally approved developments would be subject to review under the Act and to implementation of conservation measures to protect the species and their habitats. Because of these protections, threats that could jeopardize the populations would not occur. However, additional or more rigorous conservation measures may be needed for some species or populations in order to avoid or offset direct or indirect effects of development.

Threats to species that occur in relatively rare habitats could generally be avoided during facility siting. Special status fish are at risk from changes in water quality or flow patterns, and the condition of aquatic habitats supported by west slope streams are generally rated as declining in Colorado's Wildlife Conservation Strategy (BLM 2007b).

Table 3-22. Federally Listed Animal Species that May Occur in the WRFO Planning Area

Name	Species	Federal Status	Designated Critical Habitat in WRFO Planning Area
Birds			
Mexican spotted owl	*Strix occidentalis lucidis*	Threatened	No
Greater sage-grouse	*Centrocercus urophasianus*	Candidate	No
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	No
Mammals			
Black-footed ferret	*Mustela nigripes*	Endangered, Experimental Non-essential population	No
Canada lynx	*Lynx canadensis*	Threatened	No
Gray wolf	*Canis lupus*	Endangered	No
Fish			
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered	Yes
Bonytail	*Gila elegans*	Endangered	Yes
Humpback chub	*Gila cypha*	Endangered	Yes
Razorback sucker	*Xyrauchen texanus*	Endangered	Yes

Birds

Mexican Spotted Owl

There are no substantiated reports of Mexican spotted owls (*Strix occidentalis lucidis*) within the WRFO Planning Area, although small and widely separated areas of suitable habitat may be present at high elevations along the Colorado-White River divide in the Douglas Creek drainage. The nearest recorded occurrences are from Dinosaur National Monument and the upper Book Cliffs in Utah. Habitat includes deep canyons with dense old-growth conifers that exhibit high canopy closure and stand density.

Greater Sage-Grouse

Greater sage-grouse are discussed with dusky grouse and Columbian sharp-tailed grouse in Section 3.3.2.1.

Yellow-billed Cuckoo

The yellow-billed cuckoo (*Coccyzus americanus*) has declined substantially in western Colorado in the 20th century, and there are no recent records of this species from the WRFO Planning Area.

Suitable habitat includes large stands of riparian forest. Based on published habitat affinities (e.g., greater than 40-acre riverine riparian parcels composed of cottonwood gallery forest and dense deciduous shrub subcanopies), there is little likelihood that BLM-administered parcels along the White River and North Fork are capable of independently supporting a breeding pair of cuckoo. Although there are privately-owned riverine habitats above Yellow Creek (narrowleaf cottonwood associations) that may provide a suitable habitat base, BLM administers very little of this river reach (about 4 percent in 21 parcels). Below Yellow Creek, the BLM administers a larger percentage of riverine habitat, but these gallery forests are generally comprised of Fremont cottonwood with little desirable deciduous subcanopy (primarily tamarisk and Russian olive). For example, of those 17 BLM parcels between Yellow Creek and Taylor Draw dam, only 3 parcels (or about 3 percent of the reach) support willow and none of those parcels have cottonwood stands closely associated with them, private or otherwise.

Mammals

Black-footed Ferret

Although black-footed ferrets occurred historically in the WRFO Planning Area, they were extirpated by the mid-1980s or earlier. As part of species recovery, excess ferrets in the captive breeding population are being reintroduced into the wild in several states. Northwestern Colorado and northeastern Utah are one of ten primary recovery sites (Wolf Creek Work Group et al. 2001). Recovery goals include a pre-breeding population of 1,500 free-ranging breeding adults in 10 or more populations, with not fewer than 30 breeding pairs per population.

Reintroduced ferrets and their offspring in northwestern Colorado and northeastern Utah are designated as a nonessential experimental population. All of the WRFO Planning Area within Rio Blanco and Moffat counties west of SH 13 to the Utah state line is within the boundaries designated for the nonessential experimental population. Within this larger area, two ferret management areas have been designated for reintroduction efforts (Map 3-9). The Wolf Creek ferret management area occupies about 81 square miles, covers about half of the white-tailed prairie dog colonies within the WRFO Planning Area, and is part of a larger complex of prairie dog towns that extends along U.S. 40 into Utah. Since 2001, about 189 ferrets have been released in the Wolf Creek management area. Minimum year-end population estimates have increased from zero in 2001 to a range of 13 to 16 in 2005 through 2007. Since reproduction was first confirmed in 2005, the number of wild born kits has progressively increased from one in 2005, two in 2006, and at least five in 2007. First detected in 2008, ferret and prairie dog populations in the Wolf Creek Management area underwent sharp decline from a plague epizootic. A single surviving 3-year old ferret remained in Wolf Creek in 2010 and is likely now dead. The remaining ferret recorded in the WRFO during the 2010 survey effort was found along the Utah border and was believed to be a wild-borne kit that originated from Utah. Further ferret releases in the WRFO have been suspended until prey populations recover sufficiently to support reintroductions. The Coyote Basin management area occupies about 10 square miles in extreme western Rio Blanco County, and is intended to complement reintroduction efforts in the primary management zone in the adjoining part of Utah.

Canada Lynx

Lynx occurred historically in the WRFO Planning Area, and currently occur in Colorado primarily in the southwestern part of the state where CPW released 204 lynx between 1999 and 2005. Potential habitat in the WRFO Planning Area occurs primarily on the White River National Forest, and consists of mature spruce fir forests (see Map 3-9). Dispersing lynx have been found north of I-70, and into adjacent states such as Wyoming and Utah (Schenk 2006). Based on observations of dispersing lynx, individuals may occur occasionally in the WRFO Planning Area, but there is little

suitable denning or winter habitat on the largely diminutive and widely separated parcels of BLM land east of SH 13.

Gray Wolf
Gray wolves (*Canis lupus*) occurred historically throughout the WRFO Planning Area, but are considered to be extirpated in Colorado. Gray wolves introduced into Yellowstone National Park provide the closest source of dispersing individuals, and a probable wolf sighting was made near the Wyoming border near Walden in February 2006. Based on this sighting, wolves may occur sporadically in the WRFO Planning Area now and in the future. All of Colorado north of I-70 (including the entire WRFO Planning Area) is part of the Western Distinct Population Segment, under the FWS Section 4(d) rule, which allows for management of wolves dispersing from the reintroduced population in Yellowstone.

Upper Colorado River Basin Fish

Colorado Pikeminnow, Bonytail, Humpback Chub, and Razorback Sucker
The lower White River and its 100-year flood plain downstream from Rio Blanco Lake were designated as critical habitat for Colorado pikeminnow in 1994. The White River is used throughout the year by adult and subadult Colorado pikeminnow. Following closure of Taylor Draw Dam in 1984, pikeminnow were confined to the 32.5 miles of the White River below the dam. The White River does not appear to support spawning activity, young-of-year nurseries, or juvenile concentrations areas, but portions of the White River in Utah serve as concentration areas for adults and juveniles.

Critical habitat for all four endangered fish species is present in the Yampa River and its 100-year flood plain within Dinosaur National Monument. Bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) do not occur on BLM lands within the WRFO.

All waters within the WRFO Planning Area are associated with the Upper Colorado River Basin. The White River is an important flow contributor to downstream fisheries in the Green River in Utah, which provides vital nursery habitat and most of the Upper Colorado River Basin's remaining spawning and juvenile concentration areas. Kenney Reservoir operates on a run-of-the-river basis, which generally maintains natural flow regimes.

The FWS has determined that any federally authorized depletion from the Upper Colorado River Basin has an adverse effect on listed Colorado River fishes. Depletions adversely affect listed fish populations by reducing spring peak and base flows, which limits access to and the extent of off-channel waters, such as backwaters, eddies, and oxbows. These habitats are needed as larval and young-of-the-year rearing areas. In addition, reductions in flow velocity and depth adversely affect spawning and overwinter survival. Moderated flow regimes favor introduced fish populations, many of which are strongly competitive with or prey on endemic fish. The BLM prepared a 2008 statewide programmatic Biological Assessment (BA) that analyzed depletion impacts, to four big river fishes, attributable to current and projected natural gas development in the WRFO Planning Area and elsewhere in Colorado (BLM 2008c).

3.3.3.2 Other Special Status Species – Animals

Other special status species include Colorado state endangered, threatened, and special status species, and BLM sensitive species. The animal species are listed in Table 3-23, and each of these species is discussed below. Management actions pertaining to special status species, if applicable, are incorporated in the alternatives and described in more detail in Chapter 2.

Table 3-23. Other Special Status Animal Species

Name	Species	BLM Status	State Status
Birds			
Northern goshawk	*Accipiter gentilis*	Sensitive	--
Burrowing owl	*Athene cunicularia*	Sensitive	Threatened
Barrow's goldeneye	*Bucepahala islandica*	Sensitive	--
Ferruginous hawk	*Buteo regalis*	Sensitive	Special concern
Greater (northern) sage-grouse	*Centrocerus urophasianus*	Sensitive	Special concern
Western snowy plover	*Charadrius alexandrinus nivosus*	Sensitive	Special concern
Mountain plover	*Charadrius montanus*	Sensitive	Special concern
Black tern	*Chlidonias niger*	Sensitive	--
American peregrine falcon	*Falco peregrinus anatum*	Sensitive	Special concern
Greater sandhill crane	*Grus canadensis tabida*	--	Special concern
Bald eagle	*Haliaeetus leucocephalus*	Protected	Threatened
Long-billed curlew	*Numerus americanus*	Sensitive	Special concern
White-faced ibis	*Plegadis chihi*	Sensitive	--
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbiana*	Sensitive	Special concern
Brewer's sparrow	*Spizella breweri*	Sensitive	--
Mammals			
Townsend's big-eared bat	*Corynorhinus townsendii*	Sensitive	Special concern
Spotted bat	*Euderma maculatum*	Sensitive	--
Wolverine	*Gulo gulo*	--	Endangered
River otter	*Lontra canadensis*	--	Threatened
Fringed myotis	*Myotis thysanodes*	Sensitive	--
Big free-tailed bat	*Nyctinomops macrotis*	Sensitive	--
White-tailed prairie dog	*Cynomys leucurus*	Sensitive	--
Amphibians			
Boreal western toad	*Bufo boreas boreas*	Sensitive	Endangered
Northern leopard frog	*Rana pipiens*	Sensitive	Special concern
Great Basin spadefoot	*Spea intermontana*	Sensitive	Special concern
Milk snake	*Lampropeltis triangulum taylori*	Sensitive	Special concern
Reptiles			
Midget faded rattlesnake	*Crotalus viridus concolor*	Sensitive	Special concern
Fish			
Bluehead sucker	*Catostomus discobolus*	Sensitive	--
Flannelmouth sucker	*Catostomas latipinnis*	Sensitive	Special concern
Mountain sucker	*Catostomas platyrhynchus*	Sensitive	Special concern
Roundtail chub	*Gila robusta*	Sensitive	Special concern
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	Sensitive	Special concern

SOURCE: CDOW 2007

Birds

Northern Goshawk

Northern goshawks are generally presumed to nest most frequently in large blocks of forested habitats above 7,000 feet in the southern and eastern portions of the WRFO Planning Area. There are six historic northern goshawk nest sites and nine more recent nest records on BLM lands in the WRFO Planning Area. Most of the nests have been located in mature pinyon/juniper woodlands as low as 6,500 feet in the Piceance Basin. Goshawk breeding activity has also been observed in higher elevation pinyon/juniper woodlands, particularly those with intermixed stands of Douglas fir in the Piceance Basin, Douglas Creek, and Evacuation Creek basins. Mature aspen woodlands on Oak Ridge, Wilson Creek, and the upper Piceance and Douglas basins also provide suitable goshawk nesting habitat. The primary threats to northern goshawk are habitat loss and degradation (Squires and Kennedy 2006). Overall threats to northern goshawks in the Southern Rockies and Colorado Plateau are considered slight to moderate and populations in this region are stable (Partners in Flight 2005).

Burrowing Owl

Burrowing owls are uncommon summer residents, and are associated with white-tailed prairie dog colonies. They also occasionally use burrows of badgers and ground squirrels. It has been suggested that burrowing owl populations appear to be declining in western Colorado and only 20 pairs were found during extensive surveys throughout western Colorado in 2002 (Righter et al. 2004). However burrowing owl populations in the WRFO are thought to have remained relatively stable over the past five years with WRFO staff normally aware of a half-dozen nest sites annually. In 2009, the WRFO conducted comprehensive surveys for these owls in the Wolf Creek Management Area, Coal Oil Basin, and areas south of Dinosaur, CO. Thirty birds were observed with 18 documented nest sites. Threats include loss of habitat, removal or control of burrowing animals that provide nest sites, disturbance at the nest area by humans or dogs, and collisions with vehicles (CDOW 2009).

Barrow's Goldeneye

Barrow's goldeneye (*Bucepahala islandica*) nests in tree cavities at remote ponds in the Flat Tops Wilderness, which is the only known breeding location in Colorado and the southernmost portion of their breeding range (Righter et al. 2004). During the earlier portions of the winter, these birds occur on the river and ponds along the White River and Piceance Creek. Threats to Barrow's goldeneye have not been identified.

Ferruginous Hawk

This species occurs from Elk Springs west to Dinosaur and south to Rangely. Their distribution coincides closely with that of white-tailed prairie dogs which, along with cottontail rabbits, form the bulk of the birds' prey base. Based on a ferruginous hawk monitoring study conducted from 1981 through 1988, there were 94 nest sites distributed among approximately 45 breeding territories within the WRFO Planning Area, of which an average of 18 were active annually (BLM 1994). The most common nest sites were Utah junipers and artificial nest platforms built from 1981-1986 as part of a coal mine mitigation program. Dead junipers, ground nests, and promontories were also used. Nests were most likely to be occupied when there was little human activity within one mile.

Ferruginous hawk nesting effort and success are strongly correlated with their prey base and populations are prone to wide fluctuations. Surveys conducted by the FWS in 1991 and 1992 along the U.S. 40 corridor documented 5 and 14 active nests, respectively (BLM 2007b). Aerial surveys were conducted in 2009 and 2011 to document nest activity. All historical nest locations (natural

and human made) were revisited in addition to areas with suitable habitat. No nests were confirmed during these efforts. With no nests now attributable to artificial platforms, there are presumably fewer breeding territories available, but both prairie dog and cottontail populations have remained high and there have been no further land use influences which would be expected to suppress territory occupancy. Ferruginous hawks are also uncommon migrants and rare winter residents in the WRFO Planning Area. Threats to ferruginous hawks include habitat loss and degradation from energy development, altered fire regimes, invasive plant species, human disturbance during the reproductive period, severe reductions in prey base due to plague, and other causes (Collins and Reynolds 2005).

Western Snowy Plover
The western snowy plover (*Charadrius alexandrinus*) is a rare spring migrant that has been recorded regularly (13 dates) from Rio Blanco Lake. There are no fall seasonal records from Colorado. They use open shorelines, sandbars, and mudflats during migration. The primary threats are degradation of nesting and wintering habitats, which do not occur on the WRFO.

Mountain Plover
The mountain plover (*Charadrius montanus*) is a casual summer resident and spring and fall migrant. Several mountain plovers summered in Mormon Gap area along the Colorado/Utah state line in 1979-1980, and there have been a few observations of migrants in western Colorado. When found in western Colorado, they are typically observed in flat areas of sparse desert shrublands and grasslands, usually in prairie dog towns. Threats to mountain plover include loss of native habitat, loss of prairie dogs, reduced nesting success on agricultural lands, oil and gas development, and unsuitable grazing practices.

Black Tern
The black tern (*Chlidonias niger*) is an uncommon spring migrant, rare fall migrant, and casual summer visitor. There are a number of spring records from Rio Blanco Lake and Divide Creek Reservoir. Migrant birds usually occur in flocks of two to six. There is only one record of nesting in western Colorado, on a sandbar in the Yampa River eight miles north of Elk Springs in Moffat County (Righter et al. 2004). They primarily occur over open water of larger ponds and reservoirs during migration, and typically breed at marshes. Black terns are primarily threatened by loss of marsh habitat on their breeding grounds.

American Peregrine Falcon
The population of American peregrine falcon (*Falco peregrinus anatum*) collapsed in the mid-20th century due to poor reproduction related to eggshell thinning. Recovery efforts began in 1973, and, as of 2002, there were more than 100 nesting pairs of peregrine falcons in Colorado. Peregrines nest on cliffs and often near water, and they winter near riparian areas. Suitable habitat occurs along much of the White River Valley. Prior to 2007 there were no known peregrine nest sites within the WRFO Planning Area outside Dinosaur National Monument. Persistent peregrine activity near the mouth of Piceance Creek over the last eight years culminated in BLM documenting breeding efforts here from 2007-2010. An additional eyrie was located near Meeker in 2010. Threats to peregrine falcon include disturbance of their cliff nesting sites and bioaccumulation of pesticides.

Greater Sandhill Crane
About 100 pairs nest in western Colorado, primarily in Rio Blanco County near Meeker and in Routt County. Eight sandhill crane (*Grus canadensis*) nests were recorded in 1997 and 1998 near Meeker and Milk Creek on private agricultural land. Activities of the breeding population are concentrated in these areas and on private and FS holdings along portions of the upper White River

and Lost Creek. The BLM documented nesting efforts in 2002-2004 and 2008 at a single site on an isolated BLM parcel within the White River National Forest. They nest in flooded fields, beaver ponds, marshes, and wet meadows.

The entire Rocky Mountain population of about 18,000-20,000 birds migrate across the WRFO Planning Area during the spring and fall. Large autumn flights are consistently observed in western Rio Blanco County, particularly across Douglas Pass. Small groups of cranes make regular short-term use of irrigated meadows, sheetwater flats, broader drainage bottoms, and reservoir margins. Spring migration occurs primarily between mid-April and the end of May, and fall migration from mid-September to early December. Threats to greater sandhill crane are primarily loss or degradation of river and wetland habitat from residential and commercial development, changing agricultural practices, water diversions, oil and gas development, and other land use changes.

Bald Eagle
Bald eagles occur primarily as winter residents and migrants across most of the eastern and northwestern portions of the WRFO Planning Area (Map 3-9). Migrant and winter residents arrive in October and leave by mid-April. Mid-winter (December through February) populations on the White River vary from 50 to 70 birds, with migratory peaks of up to 160 birds. Winter roosts have been identified at a number of cottonwood stands along the White River between Meeker and the Utah state line and in a Douglas fir stand on private land along Piceance Creek. Winter concentrations of bald eagle occur along portions of the upper White River that remain ice-free, but opportunistic foraging occurs throughout the WRFO Planning Area. Up to 11 pairs of eagles are known to breed in the WRFO Planning Area, in cottonwood stands along the White River and, with two exceptions, on private land (NDIS 2006). Breeding pairs begin nest selection and establishment in early February, and if successful, young are fledged by mid-July. Threats to bald eagles include disruptive activities and development near communal roosts and nests, and development in important foraging areas.

Long-billed Curlew
This is a rare spring migrant and casual fall migrant in the WRFO Planning Area. The BLM has records for shoreline habitat at Rio Blanco Lake, irrigated hayland in Piceance Creek, and the saltbush communities of Coyote Basin and lower Wolf Creek. There are only a few records of breeding in western Colorado, and none in the Planning Area. Historically long-billed curlews (*Numenius americanus*) were affected by over-harvest and loss of habitat. Current threats are loss and degradation of breeding habitat from changes in agriculture and development, and disturbance and degradation of wintering habitat.

White-faced Ibis
The white-faced ibis (*Plegadis chihi*) is a common spring migrant in suitable habitat, especially the White River Valley. They occur on shallow pond and lake margins, and in irrigated hayland and wet meadows. Although a few ibis may be present in the summer, they primarily occur in April and May, and in August and September. White-faced ibis populations are currently increasing in the U.S. after large reductions in the 1960s and 1970s from pesticides and habitat loss. Current threats include loss or degradation of nesting habitat, mostly due to agricultural practices, ingestion of pesticides in agricultural areas, and disruption during the breeding period.

Columbian Sharp-tailed Grouse
Historically, Columbian sharp-tailed grouse occurred locally across the east half of the WRFO Planning Area, but currently have a more restricted distribution, mostly on private lands and land-locked BLM parcels in Axial Basin and between SH 13 north of Meeker and the White River

National Forest (Map 3-9). They have been recorded in aspen, mountain shrub, and sagebrush habitats in these areas. According to CPW, habitats within the WRFO Planning Area include overall range, smaller areas of winter range, and one small production area at the northern edge of the WRFO Planning Area. Intensive surveys in 2000 found 2,454 sharp-tailed grouse and 127 leks in Moffat, Routt, and Rio Blanco County, which is one of the three largest remaining populations in the U.S. (BLM 2007b). They have increased in recent years due to availability of suitable habitat on lands placed in the Conservation Reserve Program and lands reclaimed after coal mining. The primary threat is habitat loss and degradation from development, overgrazing, changes in fire regime, oil and gas development, and other causes. Oil and gas development could result in loss and fragmentation of habitat, displacement due to human activity, and increased mortality due to vehicle collisions and predation.

Brewer's sparrow
Brewer's sparrows (*Spizella breweri*) are common and widely distributed in virtually all big sagebrush and mixed brush communities throughout the WRFO Planning Area. These birds are typically one of the most common members of these avian communities and breeding densities probably range between 10-40 pairs per 100 acres. Although most abundant in extensive stands of sagebrush, the birds appear regularly in small (one to two acre) sagebrush parks scattered among area woodlands. Typical of most migratory passerines in this area, nesting activities normally take place between mid-May and mid-July. Threats include loss or modification of sagebrush habitat.

Mammals

Big free-tailed bat
Big free-tailed bat (*Nyctinomops macrotis*) habitat includes rocky or canyon country where individuals roost in crevices on cliff faces or in buildings. Big free-tailed bats can migrate as far north as Canada. The diet largely consists of moths. Although big free-tailed bats are not known to breed in this area, they have been documented in the Piceance Basin.

Townsend's Big-Eared Bat, and Fringed Myotis
The BLM-sensitive Townsend's big-eared bat (*Corynorhinus townsendii*), and fringed myotis (*Myotis thysanodes*) occupy a broad array of habitats in the west, and limited collections have documented their presence from western Colorado's semidesert shrublands and woodlands. Townsend's big-eared bat is often closely associated with riparian communities and permanent sources of water. The fringed myotis is more common in upland sage-steppe and xeric woodlands, including pinyon/juniper. The population of Townsend's big-eared bat is thought to be decreasing throughout much of its western range. Population trends for fringed myotis are not known.

The fringed myotis and Townsend's big-eared bat more consistently use forested habitats for roosting and foraging. More than 90 percent of the big-eared bat's diet is composed of moths. Consistent with its preferential use of uplands, the presence of non-flying invertebrates in the diet of fringed myotis suggests a foraging style that relies at least partially on foliage gleaning. Both species of bats are capable of traveling long distances between roosts and foraging areas (up to 10 miles).

Birthing and the formation of maternity colonies for these species occurs from mid-spring through mid-summer; males tend to roost singly in the summer. The core distribution of bats tends to be strongly correlated with the availability of caves, cave-like roosting habitat (e.g., mines), and buildings for night, maternity, and hibernation roosts, but these species have been found using rock crevices and trees. Bats roosting in woodland habitats use live and dead trees, roosting under loose

exfoliating bark, in cavities, or vertical cracks—attributes best served by mature large-diameter pinyon and juniper trees.

Bat abundance in the WRFO Planning Area is likely constrained by the scarceness of maternity and hibernation roost habitat that could be expected to harbor large numbers of bats (e.g., caves, mines, buildings). Rock outcrops and mature pinyon/juniper woodlands, representing potential roost substrate for small numbers of bats, particularly solitary males during the summer, are widely available in the WRFO Planning Area. Threats to these species include loss or degradation of roosting habitat in caves, mines, and snags; toxic chemicals; and loss or degradation of foraging habitat from removal of forest canopy, changes in wetland habitat, or loss of native shrub and grassland habitat.

Spotted Bat
The spotted bat (*Euderma maculatum*) is reported in the Blue Mountain area and along the Yampa River in Dinosaur National Monument, and may occur in other areas such as the lower White River. They occur in arid canyons, cliffs, and riparian areas, and roost in cracks and crevices in rocky cliffs. Population trends are not known and its distribution is very patchy. Threats include loss or modification of foraging areas and toxic chemicals. Loss or modification of roosts (cliffs and rock walls) is not considered a range-wide threat but could be a threat on a local level.

Wolverine
The current status of wolverine (*Gulo gulo*) in Colorado is uncertain; however, unverified sightings persist from the central mountains. The first confirmed sighting in more than 90 years was made in June 2009 for a male wolverine tracked by GPS from the Yellowstone area. Ruggiero et al. (1994) presents information indicating that pre-settlement wolverine distribution at the southern edge of their range was likely limited to montane boreal regions. There are historical records from lower elevation locations in the WRFO Planning Area, including the Grand Hogback and Danforth Hills, and several recent records (e.g., Blue Mountain). However, the Central Rocky Mountain Basins ecoprovince, which encompasses essentially all BLM-administered lands within the WRFO Planning Area, was specifically identified as a gap in historic wolverine distribution despite occasional records that likely represent subadult dispersal. Where they occur, wolverines have very low population densities. Threats include loss and fragmentation of habitat.

River Otter
River otters (*Lutra canadensis*) occur along the Yampa River where it borders the WRFO Planning Area, in the lower part of the White River, downstream from about Coal Ridge, and there is strong suspicion that they occur as far upstream as the confluence of the North and South Forks of the White River. Their habitat is large streams and lakes with fish. They were extirpated from Colorado by the early 20th century but CPW began restoration efforts in the 1970s. Populations appear to be stable or decreasing, and state status has been changed from endangered to threatened. Threats include changes in habitat including: streams flow and channel morphology; water pollution; loss of riparian vegetation; and human disturbance (Boyle 2006).

White-tailed Prairie Dog
Like other prairie dog species, the white-tailed prairie dog underwent an enormous reduction in population and occupied habitat by the late 20th century, mostly from poisoning, habitat changes, and plague. This species was petitioned for listing in 2002, and the FWS determined that listing was not warranted. In July 2007, the FWS announced that it would review the 2004 petition finding and take further action as appropriate because of inappropriate non-scientific influence on the finding. A

status review was initiated in 2008. The Federal notice of completion of status review was published on May 28, 2010 whereupon FWS decided that listing was not warranted.

White-tailed prairie dogs occur primarily in the salt desert shrubland and lowland grassland along U.S. 40 from Pinyon Ridge to the Utah border, in the Coal Oil Basin northwest of Rangely and the Crooked Wash area. Their towns, presently occupying about 39,000 acres in the WRFO Planning Area, provide habitat for other special status species, including black-footed ferret, ferruginous hawk, and burrowing owl. White-tailed prairie dogs are susceptible to campestral (sylvatic) plague, which periodically decimates their populations, and is the most important factor currently affecting their abundance and distribution (Pauli et al. 2006).

Reptiles and Amphibians

Boreal Toad

The boreal toad (*Bufo boreas*) occurs in marshes, wet meadows, streams and lakes, mostly at elevations of 8,500 to 11,500 feet and is likely to occur primarily on the White River National Forest in the Planning Area. There are historic records and potential habitat in the Flat Tops Wilderness and upper White River. There are no known current breeding sites, but there are reports of toad observations in recent years, mostly from the Trappers Lake area, suggesting that one or more breeding sites may be located in this area (Livo and Loeffler 2003). No boreal toads are known to exist on BLM-administered lands within the WRFO Planning Area. The primary cause of their decline and the principal continuing threat is the chytrid fungus. Other threats include alteration of wetland habitat, fragmentation of habitat, and changes in water quality.

Northern Leopard Frog

The northern leopard frog (*Rana pipiens*) was petitioned for listing as a threatened distinct population segment (DPS) in June 2006. In October 2011, the FWS determined that the listing was not warranted. This species occurs in permanent waters and associated wetland and moist upland vegetation. They are known to be well distributed along several of the lower elevation perennial and intermittent streams in the WRFO Planning Area, including the lower White River, Piceance Creek, Crooked Wash, Yellow Creek, East Douglas Creek, Cathedral Creek, and Black's Gulch. In the western U.S., northern leopard frog has undergone major population declines and has had range contractions and become locally extinct (Smith and Keinath 2007). Continuing threats include landscape-scale changes to habitats including increased roads; mortality from non-native organisms including predaceous fish, bullfrogs, the chytrid fungus, and water quality issues including pesticides.

Great Basin Spadefoot Toad

The Great Basin spadefoot toad (*Spea intermontana*) occurs along canyons and stream flood plains in pinyon/juniper woodlands, sagebrush and semi-desert shrublands at elevations below 7,000 feet. Breeding occurs in temporary pools, intermittent streams and pools formed by floodwaters along permanent streams, particularly those that support little vegetative cover along the margins. Great Basin spadefoot toads have only been recorded a few times at widely scattered locations in the WRFO Planning Area. Although eggs hatch within days of laying and larvae develop quickly, the toads require waters that persist for at least 40 days for complete larval development. There is no evidence that this species was ever abundant or well distributed in the WRFO Planning Area. Although occurring with some regularity across the Utah border, efforts by BLM to locate calling toads in the WRFO Planning Area's saltbush desert communities have not been successful to date. However, several dozen tadpoles were found in an ephemeral roadside catchment in 2009 along Cottonwood Creek near the Utah border. Populations and distribution of Great Basin spadefoot toad

appears to be fairly stable across its range, through declines have been reported in some areas (Buseck et al. 2005). Threats include alteration of aquatic breeding habitat and terrestrial foraging habitat, roads, and environmental contaminants.

Milk Snake
Known in the WRFO Planning Area from a single record (Hammerson 1999) at the mouth of Douglas Creek on the White River near Rangely, this reclusive species is thought to be more common and widespread than west slope records indicate. The milk snake (*Lampropeltis triangulum*) reportedly inhabits a wide variety of habitats, including pinyon/juniper, arid river valleys, and shrub-steppe, and prefers mid-seral understories that are not heavily dominated by grasses. Based on its abundance and distribution on the Front Range, the snake is not thought of as being particularly sensitive to moderate levels of habitat alteration. Populations are considered to be stable.

Midget Faded Rattlesnake
The midget faded rattlesnake (*Crotalus viridis concolor*) is a rare subspecies of the western or prairie rattlesnake. Differentiating this subspecies from the nominate form is difficult as the WRFO Planning Area apparently constitutes a zone of intergradation. This subspecies is thought to be generally confined to the Green River geologic formation in southeast Wyoming, eastern Utah and western Colorado, and appears to prefer bedded sandstone outcrops with fallen mid-slope slabs on south to southeast exposures below 7,000 feet in elevation. Midget faded rattlesnakes exist in small isolated groups and may exhibit classic metapopulation distribution (BLM 2007b). Two occurrences of this species were documented south of Rangely in 2009. Population trends are not known. Threats include ground surface-disturbing activities and mortality from vehicles.

Fish

Bluehead Sucker
This species occurs in a wide range of habitats from headwater streams to large rivers, in areas of moderate to fast current and rocky substrate (Woodland 1985). Within the WRFO Planning Area, they are believed to be restricted to the White River and its larger tributaries, and the Yampa River. Bluehead suckers currently occupy about 50 percent of their historic range in the Upper Colorado River Basin (Utah Department of Natural Resources 2006). Threats include diversion of water, construction of barriers to fish passage, competition with and predation by non-native fish, and destruction of riparian vegetation.

Flannelmouth Sucker
This species is generally restricted to larger streams and rivers, where it occurs in all habitat types including riffles, runs, eddies, and backwaters (Woodland 1985). It is present in the White and Yampa Rivers. Recent collections have documented the fish from Piceance Creek and most of its major tributaries, as well as lower Yellow Creek and Crooked Wash. Flannelmouth suckers occupy about 50 percent of their historic range in the Upper Colorado River Basin (Utah Department of Natural Resources 2006). Threats are the same as those for bluehead sucker.

Mountain Sucker
Mountain suckers (*Catostomus platychynchus*) occur in smaller rivers and streams, with gravel, sand and mud bottoms, in areas with undercut banks, eddies, small pools, and areas of moderate current (Woodland 1985). They are present and are often among the most frequently collected fish in the White River, Yellow Creek, and in Piceance Creek and some of its tributaries, including

Black Sulphur Creek, Fawn Creek, and Willow Creek. Population trends for mountain sucker are not known. Potential threats include any activities that result in loss or degradation of habitat.

Plains Topminnow
This small minnow is native to the Great Plains, but is also present in the White River, where it was likely introduced as a baitfish. They occur in areas with abundant filamentous algae and still, clear water. It may also occur in stockponds and in larger perennial streams throughout the WRFO Planning Area. Population trends are not known. Potential threats include activities that change stream flows or that alter physical or chemical habitat characteristics.

Roundtail Chub
The roundtail chub (*Gila robusta*) occurs in larger rivers including the White and Yampa rivers, in slow-moving waters adjacent to areas of faster water. Roundtail chub occupy about 45 percent of their historic range in the Colorado River Basin (Utah Department of Natural Resources 2006). Threats are similar to those identified for flannelmouth sucker.

Colorado River Cutthroat Trout
This subspecies of cutthroat trout is affected by loss of habitat and hybridization with non-native trout. It historically occurred in western Colorado, western Wyoming, eastern Utah, and northwestern New Mexico, with more than half of the historic habitat located in western Colorado. The WRFO Planning Area is located in one of the eight geographic management units evaluated in a recent status review (Hirsch et al. 2006), and includes three watersheds where Colorado cutthroat trout have historically occurred.

- The Upper White River watershed has 75 miles of currently occupied streams, and more than 600 miles of historic stream miles. Most of the occupied streams are located on the White River National Forest, and the only stream on BLM land is Big Beaver Creek. Big Beaver Creek is reported to have a population of 151 to 400 fish per mile, of mostly cutthroat origin, and with good quality habitat. Big Beaver Creek is managed mostly by the FS, and the BLM administers about 0.5 mile of the stream prior to its entering private lands. Other streams in this watershed with Colorado River cutthroat trout include Fawn Creek, Lost Creek, Hahn Creek, Snell Creek, Little Skinny Fish Creek, Marvine Creek, and Trappers Lake.
- The Piceance-Yellow Creek watershed has 8 miles of currently occupied stream, and 62 miles of historic stream habitat. The only extant population is located along 8 miles of Black Sulphur Creek. There are reported to be 50 to 150 fish per mile, of hybrid origin, in a stream with fair habitat quality. The Black Sulphur Creek occurrence is identified as a conservation population because of unique life history. The BLM manages about 3 miles of this creek.
- The Lower White River watershed has 16 miles of currently occupied stream habitat and 81 miles of historic habitat. Colorado River cutthroat trout occupy several streams on BLM lands in the Douglas Creek drainage, including East Douglas Creek, Bear Park Creek, Cathedral Creek, Lake Creek, and Soldier Creek. In addition, Colorado River cutthroat trout occupy Bitter Creek, which drains to the White River in Utah. Specific information on these streams is not presented in Hirsch et al. 2006. These small headwater streams are generally in fair condition with static or improving trends, and although they persist in supporting self-sustaining populations of cutthroat, they all tend to suffer the effects of high channel gradients, low flow volumes, and bank vegetation that is not fully capable of resisting erosion events (Maps 3-1 and 3-3).

3.3.4 Special Status Species - Plants

Special status plant species are those listed (threatened or endangered) or in candidate or proposed status by the FWS under the federal ESA; and those placed on the Colorado BLM State Director's Sensitive Species List. Federal threatened and endangered species and designated critical habitat are managed by the FWS in cooperation with other federal agencies, in support of recovery. For listed species that do not have designated critical habitat, the BLM cooperates with the FWS to determine and manage habitats to support the species. Federal candidate species and their habitats are managed as BLM sensitive species. On BLM-administered lands, BLM sensitive species would be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA (i.e., maintain viable populations, thereby preventing federal listing from occurring). The State of Colorado and BLM sensitive species are treated similarly. The BLM may coordinate with State natural heritage programs to develop conservation strategies and to mitigate threats to rare plants that are not designated BLM special status species. The BLM, FWS, and the State of Colorado have developed formal and informal agreements to provide guidance on the management of species. Under the Section 7 of the ESA federal agencies are required to consult with the FWS on any action they authorize, fund, or conduct that may affect a listed species or result in adverse modification of critical habitat. Additionally, BLM must conference with the FWS on any activity that may jeopardize a proposed species or if it is "likely to result" in adverse modification or destruction of proposed critical habitat. In addition, Section 7(a)(1) requires Federal agencies to use their authorities to further conservation of federally listed species. This involves BLM's cooperation with the FWS in species recovery and conservation as provided in species recovery plans for federally listed species. The Colorado Rare Plant Conservation Initiative has prepared BMPs for oil and gas development in Colorado (Elliott et al. 2009). These BMPs may be implemented on a case-by-case basis (Appendix B).

3.3.4.1 Federal Endangered, Threatened, Proposed and Candidate Plant Species

There are two federally listed plant species and one candidate species under the ESA that occur in the WRFO Planning Area (Table 3-24). In addition, one additional threatened species is known to occur within the BLM Field Offices surrounding the WRFO. However, despite ongoing surveys, occupied habitat has not been found. The two federally threatened plant species are considered endemic to the WRFO Planning Area: Dudley Bluffs bladderpod (*Physaria congesta*) and Dudley Bluffs twinpod (*Physaria obcordata*). These two wild mustards are found exclusively in the Piceance Basin of Rio Blanco County, Colorado and lie in the heart of several recent and ongoing natural gas field expansions. Because their habitats occur only in a very restricted range, on specific substrates, this greatly limits the ability of the species' to expand their range, or withstand stochastic events. Both species have not shown an ability to occupy or re-occupy habitats in disturbed or reclaimed suitable and occupied habitats, with the exception of one population on edge of the Piceance Basin on Calamity Ridge, where substrate characteristics display important differences from the populations found in the central portion of the Basin. A third federally listed plant species, Ute Ladies'- tresses (*Spiranthes diluvialis*; threatened) is currently unknown within the WRFO. However, suitable habitat may occur in the Planning Area, especially along the White River, and management actions may influence these habitats.

Table 3-24. Federally Listed and Candidate Plant Species that may Occur in the WRFO Planning Area

Name	Species	Federal Status	Designated Critical Habitat in WRFO Planning Area	Habitat
Dudley Bluffs bladderpod	*Physaria congesta*	Threatened	No	Barren, white shale outcrops of the Green River and Uinta Formations (6,000-6,700 feet)
Dudley Bluffs Twinpod	*Physaria obcordata*	Threatened	No	Barren, white outcrops and steep slopes of the Parachute Creek Member of the Green River Formation (5,900-7,500 feet)
Ute lady's tresses orchid	*Spiranthes diluvialis*	Threatened	No	Sub-irrigated alluvial soils along streams and in open meadows in flood plains (4,500-6,800 feet)
White River beardtongue	*Penstemon scariosus var. albifluvis*	Candidate	NA	Sparsely vegetated shale slopes of the Green River Formation Desert in shrub and pinyon/juniper communities (5,000-7,200 feet)
Graham's beardtongue	*Penstemon grahamii*	Proposed	NA	Talus slopes and knolls of the Green River Formation in sparsely vegetated desert scrub and pinyon/juniper (5,800-6,000 feet)

NOTE:
NA = Not applicable

The 1997 White River RMP established four ACECs (Duck Creek, Dudley Bluffs, Ryan Gulch, and Yanks Gulch) designated for Dudley Bluffs twinpod and bladderpod occupied habitats, as they were then known. Since this time, survey work has increased the known distribution and abundance of both species and their suitable habitats within and external to the ACECs. Approximately 54 percent of both Dudley Bluffs twinpod and bladderpod occur within ACECs.

One candidate species, the White River beardtongue (*Penstemon scariosus* var. *albifluvis*), occurs in white shale habitats on the western portion of the WRFO Planning Area.

Increasing industrial development in the WRFO Planning Area is increasing pressure on the two federally listed mustard species and their habitats. The FWS is currently developing a revised recovery plan for Dudley Bluffs bladderpod and Dudley Bluffs twinpod that focuses on protecting and maintaining reproducing, self-sustaining populations, by protection of core populations and surrounding buffer zones in "key conservation areas". Conservation measures, COAs, and BMPs have been established to protect these species and their habitats. Because of these protections, negative impacts to populations may be reduced or would not occur. However, additional or more rigorous conservation measures may be needed in some areas to avoid or offset direct or indirect effects of development. BLM does not intend to authorize any activity that would result in jeopardy or adverse modification of critical habitat (as determined by FWS through Section 7 consultation) to any federally listed species.

The majority of habitat fragmentation of Thirteen-mile tongue formations occurred from historic county roads and from energy lease development which included well pad, pipeline, and road locations. No known occupied habitats have been fragmented by energy activities for at least a

decade. However, several county roads and at least two large pipeline corridors have bisected occupied habitats prior to the species' federal listing in 1990.

Special status plant species are likely to maintain their current extant range because populations and habitats could usually be avoided during siting of facilities on BLM lands. However, fragmentation of suitable and potential habitats has occurred in the Planning Area prior to discovery of the Dudley Bluffs species. Occupied habitats received the greatest protection under the 1997 White River RMP; however, ongoing plant habitat fragmentation via soil disturbance, plant community type and/or seral conversion of suitable and potential habitats and pollinator habitats continue to be a long-term threat. Roadside vegetation in areas where dust is easily and continually aerosolized is generally coated with a hardened particulate film from dust settling and building up. This build-up generally does not get removed until a noteworthy precipitation event occurs.

Dudley Bluffs bladderpod

The Dudley Bluffs bladderpod grows on barren white shale outcrops of the Thirteen-mile Creek Tongue of the Green River Formation where it is exposed along downcutting drainages or windswept ridges. It often grows on level surfaces at the points of ridges or in pinyon/juniper savannah areas where narrow outcrops of somewhat level white shales are exposed. These sites may be found above steep sideslopes containing the Dudley Bluffs twinpod in the Dudley Bluffs and Ryan Gulch ACEC, but are found in exclusive habitats in the Duck Creek ACEC and surrounding drainages. Small, new populations of Dudley Bluffs bladderpod were discovered in the Dudley Gulch drainage where shallow layers of the Uinta Formation were evident above Thirteen-mile tongue substrates. The elevational range for Dudley Bluffs bladderpod is 6,140 to 6,644 feet.

The known populations of the Dudley Bluffs bladderpod include 7 occurrences consisting of more than 60 distinct mapped areas. The species occurs on an estimated 930 acres on BLM, state, and private lands in the northern Piceance Basin in Rio Blanco County within a 10 mile by 10 mile area. Approximately 88 percent of the total occupied Dudley Bluffs bladderpod and Dudley Bluffs twinpod habitat occurs on public lands managed by the BLM. The BLM has designated four ACECs (Duck Creek, Yanks Gulch, Dudley Bluffs, Ryan Gulch), which contain approximately 54 percent of the total occupied habitats. The estimated total number of known Dudley Bluffs bladderpod plants is around 546,000 (Colorado Natural Heritage Program [CNHP] 2009). Although population boundaries do show precipitation response changes, among other effects, small populations continue to be identified, and the species range has not increased since the 1990 federal listing.

The BLM has conducted long-term monitoring in conjunction with the Colorado Natural Areas Program (CNAP) on the ACEC populations of both species from 1985 to 2009. At the Dudley Bluffs ACEC, the results indicate a stable, to increasing, trend in Dudley Bluffs bladderpod plant numbers. In a small area where plants were destroyed, the population continued to decline, and new recruits were very slow to recolonize the area. At the Duck Creek ACEC, bladderpod numbers decreased 10 to 35 percent from 1996 to 2002. These declines were presumed to be linked to the increasing size of the wild horse herd and low levels of precipitation. The BLM has since reduced the horse herd, but subsequent monitoring results (2002 to 2006) continued to show a substantial decline in plant numbers at two monitoring locations within the Duck Creek ACEC. The cause of the continued decline has not been determined (Rickey and Kurzel 2007). Overall, ongoing monitoring indicates mixed results, suggesting there may be other causative factors.

The primary threats to both Dudley Bluffs bladderpod and Dudley Bluffs twinpod are oil and gas development (FWS 2008). Other threats include extraction of leasable solid minerals, off-highway

vehicles (OHV), and invasive species. These species may also have localized effects from grazing and trampling by livestock and wild horses.

Dudley Bluffs twinpod

The Dudley Bluffs twinpod grows on barren white shale outcrops of the Thirteen-mile Creek Tongue of the Green River Formation where it is exposed along downcutting drainages, sometimes occurring below or interspersed with Dudley Bluffs bladderpod habitats. The twinpod occurs primarily on the Thirteen-mile Creek Tongue but also occurs without adjacent bladderpod habitats on the Parachute Creek Member of the Green River Formation near Calamity Ridge. The Dudley Bluffs twinpod occurs almost solely on steep side slopes. However, it is also found in small wash settings below sideslopes where soil and substrates have eroded and deposited on more level locations. Shifting substrates and soil loss from highly erosive soils, especially on steep slopes, are probably major sources of natural mortality. The elevation range for the Dudley Bluffs twinpod is 5,960 to 7,440 feet.

The known populations of the Dudley Bluffs twinpod include approximately 10 occurrences comprised of at least 40 distinct mapped areas. The plants occur on an estimated 320 acres on BLM, state, and private lands in the northern Piceance Basin in Rio Blanco County; within a 20 mile by 30 mile area. Approximately 88 percent of the total occupied Dudley Bluffs bladderpod and Dudley Bluffs twinpod habitat occurs on public lands managed by the BLM. The estimated total number of Dudley Bluffs twinpod plants is around 35,000 (CNHP 2009). At the Ryan Gulch ACEC, the Dudley Bluffs twinpod population increased in size and numbers between 1993 and 2000. This increase may be linked to a livestock exclosure (includes habitat for both species) designed to exclude cattle and prevent browsing of flower heads and trampling of plants.

During the spring of 1991 and 1992 field research by Tepedino (2009) was conducted in the Lower Ryan Gulch population, showing that the Dudley Bluffs twinpod is an obligate outcrosser (plants require pollen from other plants in order to successfully reproduce) that requires pollinators. This study focused on Dudley Bluffs twinpod but some pollinators were collected for the Dudley Bluffs bladderpod as well. Primary pollinators for Dudley Bluffs twinpod are ground-nesting native bees in the families Andrenidae and Halictidae. Most species that frequented Dudley Bluffs twinpod flowers are generalists, which also visit a variety of other flower types. Only two bee species were likely mustard family specialists (*Andrena hicksi* and *Andrena walleyi*). The only non-bee pollinator of any importance was a species of the dipteran, *Gonia* (Tachinidae). Although no bee is likely to travel more than 0.6 of a mile from the nesting site, the field research indicated there was no evidence that sexual reproduction of plants at the Ryan Gulch population was being limited by inadequate pollination in 1992 (Tepedino 2009).

Threats are the same as described for Dudley Bluffs bladderpod.

Ute –lady's tresses

This species has not been found in the WRFO Planning Area, but is known in adjacent counties in Utah within Dinosaur National Monument, and within portions of the Monument north of the WRFO Planning Area in Colorado (Fertig et al. 2005). In addition to several large Green River populations, smaller populations have also been found in small creeks and hay meadows that are found more proximate to the WRFO within the Monument, especially where intermittent disturbance such as haying and irrigation were occurring that prevented late-seral plant community formation. A new population was found in 2007 in the Roaring Fork Valley, about 35 miles southeast of the WRFO (Colorado Natural Heritage Program 2007). Suitable habitats include sub-irrigated alluvial soils along rivers, streams and open meadows that display a previous

disturbance regimen and usually contain a diverse, mid-seral plant community where light penetration through the herbaceous canopy is still visible to the soil level. It is likely that the species requires a decade of vegetative growth prior to flowering; consequently, areas of constantly changing alluvial deposition with early seral vegetation would be devoid of the orchid. Elevation ranges for Ute lady's tresses are about 4,500 to 7,200 feet.

White River Beardtongue
The White River beardtongue (*Penstemon scariosus var. albifluvis*) is known to be within five locations on the WRFO. Three of these populations occur in the Raven Ridge ACEC. Two populations have been found south of the White River; one is located approximately 11 miles south of the White River on the Utah/Colorado border and the other is located approximately 3 miles east of the Utah/Colorado border slightly south of the White River. The White River beardtongue occupies less than 50 total acres on the WRFO. Most of the population is found in Utah, where the total population was estimated in 1994 to cover about 200 acres and have about 23,000 individuals in 14 discrete occurrences (Franklin 2005). This penstemon is found on steep exposures of the Parachute Creek member of the Green River Formation. This loosely deposited formation often forms narrow benches that occur in horizontal bands within extremely steep white shale slopes. The plants are found protruding from the benches, often with a small suite of other shale-barren species such as the Ephedra buckwheat (*Eriogonum ephedroides*; BLM sensitive). Suitable habitat consists of sparsely vegetated shale slopes at elevations of 5,000 to 7,800 feet (Spackman et al. 1997).

Threats include development of oil and gas and oil shale, recreational OHV use, livestock grazing and trampling by wildlife and livestock (FWS 2009).

Graham's beardtongue
Graham's beardtongue (Penstemon grahamii) occurs in the WRFO Planning Area on 11 mapped locations primarily near Raven Ridge and along the Utah border north of Park Canyon. Most of the populations occur in Utah in Uintah County, Utah (FWS 2006a). Graham's beardtongue occurs on approximately 1,300 acres on the WRFO, with all but approximately 14 acres occurring within the Raven Ridge ACEC. Suitable habitat consists of sparsely vegetated desert shrub and pinyon/juniper communities on talus slopes and knolls of the Green River Formation, at elevations of 5,800 to 6,000 feet (Spackman et al. 1997). The steep shale barren habitats are similar, and often adjacent to White River penstemon populations, although the two species have not been found occupying the same habitat locations. This species was removed from the federal candidate list in 2006 (FWS 2006b) because threats to the species and its habitat were considered unlikely to endanger or threaten the species within the foreseeable future. However this decision was challenged in 2008 and later reversed in 2011 by the U.S. District Court. Currently, Graham's beardtongue is proposed for federal listing. There have been 109 occurrences with an estimated total population of 6,200 individuals. All of the known occurrences are on oil shale rich strata of the Green River Formation. The listing proposal identified oil shale, tar sand, and oil and gas development as threats to Graham's beardtongue. No oil shale or tar sand developments are currently proposed within Graham's beardtongue habitat, and oil and gas developments have not previously and are not currently influencing known Graham's beardtongue habitats on the WRFO.

3.3.4.2 Other Special Status Species

The BLM designated sensitive plant species also include federal candidate species and delisted species in the five years following delisting. These species are listed in Table 3-25, and each of these species is discussed below. Management actions pertaining to special status species, as applicable, are incorporated in the alternatives and described in more detail in Chapter 2.

Table 3-25. Other Special Status Plant Species

Name	Species	BLM Status	State Status	Habitat
Debris milkvetch	*Astragalus detritalis*	Sensitive	G3/S2	Pinyon/juniper and mixed desert shrub, often on rocky soils ranging from sandy clays to sandy loams. Also alluvial terraces with cobbles (5,400-7,200 feet)
Duchesne milkvetch	*Astragalus duchesnensis*	Sensitive	G3/S1S2	Pinyon/juniper woodland and desert shrub, around sandstone or shale outcrops (4,600-6,400 feet)
Ligulate feverfew	*Bolophyta ligulata* (*Parthenium ligulatum*)	Sensitive	G3/S2	Barren shale knolls (5,400-6,500 feet)
Tufted cryptantha	*Cryptantha caespitosa* (*Oreocarya caespitosa*)	Sensitive	G4/S2	Sparsely vegetation shale knolls, with pinyon/juniper or sagebrush; usually with other cushion plants (5,500-8,100 feet)
Rollins cryptantha	*Cryptantha rollinsii* (*Oreocarya rollinsii*)	Sensitive	G3/S2	White shale slopes of the Green River Formation, in pinyon/juniper or cold desert shrub communities (5,300-5,800 feet)
Ephedra buckwheat	*Eriogonum ephedroides*	Sensitive	G3/S1	Shale and clay flats of slopes in saltbush, sage and pinyon/juniper habitats (4,900-6,900 feet)
Cathedral Bluff dwarf gentian	*Gentianella tortuosa*	Sensitive	G3?/S1	Barren shale knolls and slopes of the Green River Formation (8,500-10,800 feet)
Narrow-stem gilia	*Alciella stenothyrsa* (*Gilia stenothyrsa*)	Sensitive	G3/S1	Grassland, sagebrush, mountain mahogany or pinyon/juniper; silty to gravelly loam soils of the Green River formation (6,200 -8,600 feet)
Piceance bladderpod	*Lesquerella parviflora*	Sensitive	G2/S2	Shale outcrops of the Green River Formation, on ledges and slopes of canyons in open areas (6,200-8,600 feet)
Flaming Gorge evening primrose	*Oenothera acutissima*	Sensitive	G2/S2	Seasonally wet areas in meadows, depressions or along arroyos I mixed conifer forest to sagebrush, on sandy gravelly, or rocky soils (5,300-8,500 feet)
Cathedral Bluff Meadow- rue	*Thalictrum heliophilum*	Sensitive	G2/S2	Sparsely vegetated, steep shale talus slopes of the Green River Formation (6,300-8,800 feet)

NOTE: Habitat descriptions are from Spackman et al. 1997.

Increasing industrial development of coalbed methane extraction in the WRFO Planning Area is currently increasing pressure on the Debris milkvetch. Habitats for the remaining 11 BLM-sensitive species have not previously and are not currently experiencing full field energy development at the landscape level. Previous habitat changes from inter-state pipeline, and powerline corridors has influenced the Piceance bladderpod (*Lesquerella parviflora*); however, these effects have had limited impacts on local populations, and this member of the wild mustard family has shown an initial ability to re-establish following site reclamation in some areas. A few (less than three each) Ephedra buckwheat and Cathedral Bluff dwarf gentian (*Gentianella tortuosa*) populations have been linearly bisected by historical Rio Blanco county road and BLM road construction.

Several plant species addressed in the 1997 White River RMP are no longer considered to be BLM sensitive, although most are still fully tracked by the Colorado Native Heritage Program. These include oil shale columbine (*Aquilegia barnebyi*), dragon milkvetch (*Astragalus lutosus*), oil shale fescue (*Argillochloa dasyclada*), Yampa beardtongue (*Penstemon yampaensis*), and Purpus' sullivantia (*Sullivantia purpusii*). Oil shale fescue, Yampa beardtongue, and Purpus' sullivantia are still fully tracked by CNHP, and dragon milkvetch is on their watch list.

Debris milkvetch
On the WRFO, debris milkvetch is known to be approximately 18 scattered locations (approximately 90 acres) that are found along a north-south corridor that occurs between U.S. 40 and Fletcher Gulch, a distance of approximately 16 miles. In addition, approximately 10 acres of occupied habitat is known just west of Meeker, Colorado, and another 22 acres of Debris milkvetch habitats from the north end of the Raven Ridge ACEC. Endemic to the Uinta Basin, the milkvetch is confined to Moffat and Rio Blanco counties in Colorado and Duchesne and Uinta counties in Utah. It has a wider distribution in Utah and is known to be within at least 36 locations (Franklin 2005). It occurs on Colorado Plateau pinyon/juniper sites intermixed with low sagebrush shrublands on silty clay loams soil, and on alluvial terraces with cobbles, at elevations that range from 5,400 to 7,200 feet. It blooms in May.

Increasing industrial development of coalbed methane extraction is occurring in the southern portion of its known range on the WRFO. Road, pad, and pipeline construction is currently creating landscape-level fragmentation adjacent to several Debris milkvetch populations. However, facilities are currently being positioned to avoid occupied habitat and to minimize fragmentation of pollinator habitats between adjacent populations. COAs and BMPs have been established to protect the species and their habitats. Because of these protections, impacts that would jeopardize the populations would not occur. However, additional or more rigorous conservation measures may be needed for some sensitive plant species or populations in order to avoid or offset direct or indirect effects of development to prevent negative cumulative effects. Other threats to debris milkvetch include noxious weeds via current and ongoing energy development corridors that are proximate to populations; cheatgrass stand changes; and disturbance from OHV use and wild horses.

Duchesne milkvetch
There are three known occurrences of Duchesne milkvetch (*Astragalus duchesnensis*) on the west side of the WRFO – one in the Raven Ridge ACEC at an elevation of 5,800 feet, one 15 miles to the south near the top of Big Horse draw at 6,500 feet, and one at the northern edge of the Planning Area in Dinosaur near Wagon Wheel Point at 5,800 feet. These three locations are approximately 15 miles apart. Oil and gas developments have not previously and are not currently influencing known Duchesne milkvetch habitats on the WRFO, although Big Horse Draw is about 0.25 mile south of a large oil and gas trunk line. Duchesne milkvetch is a Uintah Basin endemic, only known to occur in Rio Blanco and Moffat counties, Colorado, and in three counties in Utah where there are at least 14 separate occurrences (Albee et al. 1988).

Ligulate feverfew (Colorado Feverfew)
This is a mound-forming herbaceous perennial that occurs on semi-barren outcrops of several geologic formations. In the WRFO, ligulate feverfew (*Bolophyta ligulata*) occurs on barren shale exposures of the Parachute Creek Member along Raven Ridge, and in Evacuation Creek, White Faced Butte, Park Canyon, and along the border with Utah west of Rabbit Mountain. At least two occurrences of the species are known in the Raven Ridge ACEC near Mormon Gap, at approximately 5,500 feet in elevation. In addition to occurrences in Rio Blanco and Moffat counties, Colorado, this species occurs in six counties in Utah where there are at least 17 separate occurrences in northeast and north-central parts of the state (Albee et al. 1988). On the WRFO, energy development has not occurred in or adjacent to ligulate feverfew habitats.

Tufted cryptantha
In the WRFO, tufted cryptantha (*Cryptantha (Oreocarya) caespitosa*) occurs at three locations west of the Raven Ridge ACEC on the Colorado/Utah border. The center of this plant's distribution is in Wyoming, where there are more than 130 occurrences in 11 counties (University of Wyoming

1998). In addition, this species occurs in Rio Blanco and Moffat counties in Colorado, five counties in Utah where there are at least 11 occurrences (Franklin 2005), and one county in Idaho (NRCS 2009). It occurs on sparsely vegetated clay knolls usually with other cushion plants, in pinyon/juniper and sagebrush communities. Threats are unknown.

Rollins' cryptantha

Rollins' cryptantha (*Cryptantha rollinsii*) is a biennial herb up to about 18 inches in height that occurs on white shale knolls in pinyon/juniper and sagebrush habitats (Natureserve Explorer 2009). It flowers in May. Rollins cryptanth occurs on exposures of the Parachute Creek Member of the Green River Formation at elevations of 5,300 to 5,800 feet. It occurs along Raven Ridge in the Raven Ridge ACEC, White Faced Butte, Park Canyon, and Rabbit Mountain. These locations occur on the WRFO's western edge near the Colorado/Utah border. Populations are also known in five Utah counties with at least 31 separate occurrences (Albee et al. 1988) and one Wyoming County. Additional survey for this species may increase the known species' range in the WRFO as potential habitats may occur along the White River just west of Raven Ridge in Lower Evacuation Creek, and perhaps in other oil-shale barren areas within the Piceance Basin as recorded in undocumented occurrence data.

Ephedra buckwheat

Ephedra buckwheat, a diminutive member of the large group of buckwheats that occur on shale barren habitats in the WRFO, also prefers sparsely vegetated outcrops of Green River Formations. It is known to occur on approximately 80 acres (9 occurrences) in the Raven Ridge ACEC. At least two additional populations have been identified south of the ACEC and account for approximately 30 acres. It also occurs in Uintah County, Utah, but the distribution within the county is not known (NatureServe 2009). A few (less than three each) Ephedra buckwheat and Cathedral Bluff dwarf gentian populations have been linearly bisected by historic Rio Blanco county and BLM road construction. Energy development is not occurring in Ephedra buckwheat habitats in the WRFO.

Cathedral Bluff dwarf gentian

Cathedral Bluff dwarf gentian is a clump-forming annual up to 4 inches tall that blooms in July or August. This unique dwarf upland gentian occurs on more open shale knolls and rolling slopes at several sites in open grassland saddles of the Cathedral Bluffs, which are the only known Colorado locations for this species. They occur on four sites totaling approximately 50 acres on the WRFO, with one-half of these occurrences near the east edge of the East Douglas Creek ACEC. These sites are located within the Cathedral Bluffs ACEC. Additional habitats are suspected in the area. Utah gentian populations have been linearly bisected by historical Rio Blanco CR 122 and the Calamity Ridge Road. Livestock, wild horse, and other ungulate grazing occurs on Calamity Ridge; however, energy-related disturbance has not involved the Utah gentian to date. In addition to the occurrences on Cathedral Bluffs, this species also has at least 12 occurrences in 8 counties in Utah (Albee et al. 1988) and occurs in 1 county in Nevada.

Narrow-stem gilia

Narrow-stem gilia (*Aliciella [Gilia] stenothyrsa*) is a biennial or perennial herb up to about 20 inches tall with a basal rosette. Narrowstem gilia occurs on silty to gravelly loam soils derived from the Green River or Uintah Formations, in grassland, sagebrush, mountain mahogany, or pinyon/juniper communities, at 5,000 to 6,000 feet elevation (Spackman et al. 1997). It blooms in late May or June. Only a few acres (less than 10) of the narrowstem gilia have been found on the WRFO. It has been observed in the lower part of Greasewood Creek and near Blue Mountain in habitats located west and north of the Coal Rim ACEC. The sites in lower Greasewood Creek are located within the Lower Greasewood ACEC. Narrowstem gilia is only known to be in Rio Blanco

County in Colorado, but there have been at least 25 occurrences in five Utah counties (Albee et al. 1988). Energy development is not occurring in current narrow-stem gilia habitats in the WRFO.

Piceance bladderpod

Piceance bladderpod grows as small rosettes with silvery leaves and blooms from May through July. Like the Dudley Bluffs twinpod, this species is an edaphic endemic, known to occur in Green River Formations in the Piceance Basin and adjacent areas. It is endemic to Colorado, occurring in Rio Blanco, Garfield and Mesa counties. It has not been found in habitats in common with either Dudley Bluffs species. There are approximately 35 mapped occurrences that cover approximately 140 acres on the WRFO. Approximately 10 acres are found within the East Douglas Creek ACEC. These areas range in elevation from approximately 7,000 to 8,500 feet. The Piceance bladderpod occupies steep exposures of Green River-derived soils in the Piceance Basin near Timber Gulch (and surrounding drainages) and very steep, often west-facing escarpments along the Cathedral Bluffs. A few populations are also known from Calamity Ridge. Noxious weed spraying for leafy spurge in Hay Gulch, and surrounding areas, has the potential to affect isolated Piceance bladderpod populations. Previous habitat changes from inter-state pipeline and powerline corridors have also influenced the Piceance bladderpod; however, these effects have had limited impacts on local populations, and this member of the wild mustard family has shown some ability to re-establish following site reclamation. Threats include oil and gas development, oil shale, and off-road vehicles.

Flaming Gorge evening primrose (*Oenothera acutissima*)

Flaming Gorge evening primrose (*Oenothera acutissima*) only occurs in Moffat County in Colorado and in two counties in Utah, where there are 13 occurrences (Franklin 2005). Within the WRFO Planning Area, this species is only known in the Blue Mountain area, where it is currently in intermittent shallow soil drainages above 7,000 feet elevation. Entire sandstone beds are exposed in many areas, which create moist habitat associated with seeps, and/or late spring over-surface flow that drain into narrow rock surface fractures. One historically mapped population, and several new occurrences, are known to occur on BLM lands that lie adjacent to Dinosaur National Monument north of Blue Mountain near the Colorado/Utah border. Survey of potential habitat for this species has not been widespread and additional populations are likely to occur. The known habitats are within several grazing allotments, and some isolated two-track road and fence construction may be affecting the species in a limited manner; however, energy development in this area has not occurred and is not occurring. This species could be adversely affected by livestock grazing due to its occurrence in areas with nearby water and lush forage (O'Kane 1988).

Graham's beardtongue

Graham's beardtongue (*Penstemon grahamii*) occurs in the WRFO Planning Area on 11 mapped locations primarily near Raven Ridge and along the Utah border north of Park Canyon. Most of the populations occur in Utah in Uintah County, Utah (FWS 2006a). Graham's beardtongue occurs on approximately 1,300 acres on the WRFO, with all but approximately 14 acres occurring within the Raven Ridge ACEC. Suitable habitat consists of sparsely vegetated desert shrub and pinyon/juniper communities on talus slopes and knolls of the Green River Formation, at elevations of 5,800 to 6,000 feet (Spackman et al. 1997). The steep shale barren habitats are similar, and often adjacent to White River penstemon populations, although the two species have not been found occupying the same habitat locations. This species was removed from the federal candidate list in 2006 (FWS 2006b) because threats to the species and its habitat were considered unlikely to endanger or threaten the species within the foreseeable future. There have been 109 occurrences with an estimated total population of 6,200 individuals. All of the known occurrences are on oil shale rich strata of the Green River Formation. The listing proposal identified oil shale, tar sand, and oil and

gas development as threats to Graham's beardtongue. No oil shale or tar sand developments are currently proposed within Graham's beardtongue habitat, and oil and gas developments have not previously and are not currently influencing known Graham's beardtongue habitats on the WRFO.

Cathedral Bluff meadow-rue

The Cathedral Bluff meadow-rue (*Thalictrum heliophilum*) grows on sparsely vegetated steep talus slopes and ridges of the Parachute Creek Member of the Green River Shale. Populations of this species are found only in Garfield, Mesa, and Rio Blanco counties in Colorado, with 36 known occurrences and approximately 130,000 individuals (Neely et al. 2009).

3.4 Wild Horses Management

Wild horse management within BLM-administered lands of the WRFO Planning Area follows the Wild Free-Roaming Horses and Burros Act of 1971, as amended (Public Law 92-195) and 43 CFR 4700 (Protection, Management, and Control of Wild and Free-Roaming Horses and Burros). The 1975 White River Resource Area Management Framework Plan (MFP) identified two wild horse units: the Piceance Basin Herd Unit and Douglas Herd Unit. The Douglas Herd Unit included what is now the East Douglas portion of the Piceance/East Douglas Herd Management Area and the West Douglas Herd Area (HA). The East and West Douglas areas were physically separated by completion of SH 139 right-of-way fence in 1983. In 2007, BLM completed the West Douglas Herd Area Plan Amendment to the 1997 White River RMP to discontinue maintaining the wild horse population in the West Douglas HA. The wild horses are presently distributed among the Piceance-East Douglas HMA, the West Douglas HA, and the North Piceance HA (Table 3-26). A wild horse management plan for the Piceance-East Douglas HMA was approved in June 1981.

Wild horses are presently managed within the Piceance-East Douglas HMA in the WRFO Planning Area (Map 3-11). Appropriate management levels for wild horses and burros are established in accordance with the 1975 MFP and objectives and management actions through Multiple Use Decisions. Multiple Use Decisions establish the appropriate minimum and maximum number of wild horses to be managed within each grazing allotment contained within an HMA or HA. Annual monitoring data are collected to evaluate progress toward meeting management objectives. AMLs are established based on "an intensive monitoring program involving studies of grazing utilization, trend in range condition, actual use, and climatic factors" (109 Interior Board of Land Appeals 120). The AML, objectives, and management actions may be modified in future Multiple Use Decisions for the grazing allotments contained within an HMA. Wild horses that establish home ranges outside of HMA or HA boundaries are removed during gathers. Wild horses are removed from private lands at the request of the landowner and after reasonable efforts to keep the animals off private lands have failed.

Table 3-26. Wild Horse Herd Management and Herd Areas

Herd Management Area and Herd Areas	Acres				AML
	BLM	CDOW	Private	Total Acres	
Piceance-East Douglas HMA[(1)]	158,200	8,000	23,800	190,000	135-235
West Douglas HA	123,400	0	4,800	128,200	0
North Piceance HA	76,300	0	13,000	89,300	0
Total	357,900	8,000	41,600	407,500	135-235

SOURCE: BLM 2005c.

NOTE:

[(1)] Includes Greasewood Addition

Current conditions within the WRFO Planning Area show that wild horse populations continue to grow, often exceeding AMLs (see Table 3-27). The estimated population of wild horses was 559 in the fall of 2010 and 583 by fall of 2011. Various factors including drought conditions, historic grazing, wildfires, and wild horse population growth may adversely affect habitat and in some instances herd health. The trend for wild horses; however, is moving toward a desired condition as wild horse management efforts (including horse gathers to attain AMLs and fertility control methods as well as sex ratio adjustments in the herd) attempt to moderate population growth and habitat degradation. During 2006, fertility control was used on 28 mares that were returned to the Piceance-East Douglas HMA. The WRFO completed a planned wild horse gather operation on September 30, 2011 which removed 260 wild horses from the HMA, North Piceance Herd Area, and areas just outside of the HMA except for the West Douglas Herd Area. Management actions are incorporated in the alternatives and described in more detail in Chapter 2.

Table 3-27. Wild Horse Populations in Herd Management and Herd Areas

Period	Herd Management or Herd Area			
	North Piceance HA (Number of Individuals)	Piceance-East Douglas HMA (Number of Individuals)	West Douglas HA (Number of Individuals)	Outside HMA or HA[1] (Number of Individuals)
Fall 1996	31	525	155	85
Spring 1997	31	286	95	55
Fall 1997	37	208	114	66
Fall 1998	42	242	65	10
Spring 1999	42	242	65	10
Fall 1999	14	198	78	12
Fall 2000	37	343	114	66
Spring 2002	39	294	77	44
Fall 2002	15	202	92	13
Fall 2003	17	242	111	16
Fall 2004	18	291	133	19
Spring 2005	No Inventory	No Inventory	97	97
Fall 2005[2]	55	349	116	45
Spring 2006[2]	25	363	No Census	27
Fall 2006[3]	8	216	139	30
Spring 2010 (Inventory Year)	49	265	73	79

SOURCE: BLM, 2006-2008.

NOTES:

[1]This area includes all of the wild horses in the Douglas Creek Basin area outside of the Piceance-East Douglas HMA.

[2]Population for these periods is based on projections.

[3]Fall gather occurred, wild horses were removed.

3.5 Wildland Fire Ecology and Management

Changes in National Fire Policy since the 1997 White River RMP have resulted in greater emphasis on restoring the role of fire in ecosystem function where possible. Fire management planning begins at the land use plan level (i.e., the 1997 White River RMP) and then those land use plan decisions are implemented using activity-level plans. The 1997 White River RMP provides guidance on desired conditions and identifies allowable uses and management actions designed to achieve those desired conditions. The activity-level plan or Fire Management Plan (FMP) carries forward the direction for landscape scale planning by more specifically outlining management response and

providing on-the-ground implementation direction needed to meet the objectives outlined in the RMP. The BLM maintains a current FMP that identifies fire management units (FMUs), values at risk, and communicates appropriate management response for all federally managed lands in the WRFO. Fire rehabilitation methods are described in the WRFO FMP (BLM 1999b). In those FMUs with relatively few values at risk of wildfire, the FMP may list wildland fire use (WFU) as an appropriate management response to manage wildfire ignitions. Prescribed fire and WFU operations have increased in the WRFO since the last RMP. Prescribed and WFU fires typically occur in the higher elevations of the WRFO.

Current fire regime condition class (FRCC) indicates the degree of departure from the historic fire regime (HFR) (Hann and Bunnell 2001) (Table 3-28). The classification is based on a relative measure describing the degree of departure from the historic natural fire regime in terms of either fire frequency or stand replacement. Extreme departure from the HFR results in changes to one or more of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g., insect and diseased mortality, grazing, and drought).

Table 3-28. Current Fire Regime Condition Classes

FRCC Condition Class	Attributes
Condition Class 1	• Fire regimes are within or near an historical range. • The risk of losing key ecosystem components is low. • Fire frequencies have departed from historical frequencies by no more than one return interval. • Vegetation attributes (species composition and structure) are intact and functioning within an historical range.
Condition Class 2	• Fire regimes have been moderately altered from their historical range. • The risk of losing key ecosystem components has increased to moderate. • Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been moderately altered from their historical range.
Condition Class 3	• Fire regimes have been significantly altered from their historical range. • The risk of losing key ecosystem components is high. • Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been significantly altered from their historical range.

SOURCE: FRCC 2007.

Most of the WRFO Planning Area (72 percent) is in the FRCC 2 category. The remaining 28 percent of the WRFO Planning Area is in the FRCC 3 category. None of the WRFO Planning Area is in the FRCC 1 category (Map 3-12).

The WRFO manages wildfire and fuels by categorizing certain areas into FMU polygons. Resource specialists typically delineate each FMU according to several characteristics including: (1) FRCC category; (2) natural disturbance patterns based on fire history data and physical features such as land forms and vegetation; (3) areas of concern and limitations for fire management activities;

(4) areas where wildland fire might be desired; (5) areas where use of wildland fire may be desirable but the threat to private property and life would preclude WFU, such as in wildland-urban interface areas; (6) developed sites, such as recreational and cultural sites, where any type of fire is not desired.

There have been minor shifts in FRCC since the last RMP. The fuel structure is gradually changing in low elevation portions of the WRFO due to management practices and incursion of non-native annual grasses, primarily cheatgrass. Fire frequencies and size are increasing in low elevation shrub communities (sagebrush and salt desert shrub types) where cheatgrass becomes established because it provides a more continuous surface fuel than the historic vegetation community. In areas where fuels are continuous, fire spreads rapidly during the fire season. The fire season normally begins in late April and runs through early November with peak fire season occurring between May 1 and August 31.

In the higher elevation sagebrush communities where mountain big sagebrush often intermingles with early seral pinyon/juniper, a combination of factors other than cheatgrass altered current FRCC. Under HFR I or II, relatively frequent wildfires promoted the mortality of pinyon/juniper and regrowth of herbaceous vegetation in following years. Sagebrush moved in gradually afterwards as wildfire maintained a mosaic pattern of vegetation that displayed low incidences of pinyon/juniper. Historic grazing practices reduced the herbaceous grasses and forbs which had historically carried wildfires through these communities. Meanwhile, fire suppression encouraged pinyon/juniper, a species that does not tolerate fire. Without wildfire, pinyon/juniper could create a canopy over low growing shrubs and grasses, effectively shading them out. This increase in woody vegetation and reduction in fine fuels does not carry wildfire as well. Consequently, fire extent has decreased and fire frequency has lengthened in some of these communities.

Fire suppression has not altered fire regimes in the late seral pinyon/juniper (>100 years old). The growth form of this community creates stand-replacement fires that occur very infrequently, so recent fire suppression activities have not affected fire frequencies, extents, or severity in this woodland type.

In some ponderosa pine and Douglas fir forest types of the WRFO, fire suppression has altered fuel structure over time. Under historic conditions, relatively frequent wildfire of low intensity maintained a forest with little ladder fuels and a high canopy openness ratio. Wildfires rarely reached the forest canopy, and if they did, they did not carry through the canopy due to a lack of continuity. Thirty years of effective fire suppression has increased the presence of ladder fuels in some of these forests and the tree canopy has become more continuous. In these instances, there is a greater probability of higher intensity stand-replacement fires that occur less frequently. However, this alteration is not likely to result in a loss of key ecosystem components as indicated by the lack of FRCC 3 throughout the WRFO Planning Area. It should be noted that the ponderosa pine and Douglas fir forest types of the WRFO are relatively small. They have always displayed a high incidence of pinyon/juniper, which extended their HFR to a "classic" ponderosa pine and Douglas fir forest (HFR 1).

3.5.1 Unplanned/Wildland Fire

Management objectives for naturally ignited fires as well as constraints on fire-fighting activities are provided in the 1997 Wither River RMP. Current wildland fire conditions are described in detail in the WRFO FMP (BLM 1999b). Table 3-29 shows, by years, all reported wildland fires in the WRFO, Wildland Fire Use, and annual acreages that were reported and submitted in the Wildland

Fire Management Information System (WFMI) 1202 reports Craig Interagency Dispatch Center reports for daily and annual activity. The acres shown are the acres reported on the last electronic ICS submitted and are not necessarily the official acres for that incident. A large fire is defined as 100 acres or more in timber fuel types, 300 acres or more in grass fuel types, or a fire that has a Type 1 or Type 2 Incident Management Team (IMT) assigned.

The 1997 White River RMP provides guidance and identifies approximately 639,600 acres as prescribed natural fire areas where fire will be managed to achieve resource conditions. The number and acreage of WFU fires have increased in the Planning Area since the last RMP. From 2000 through 2007, the WRFO managed 21 fires for 13,793 acres to help achieve resource objectives as shown in Table 3-29. The first was in 2001, the Black Mountain Fire burned 29 acres, and the first large WFU was when the Yankee Gulch Fire burned a total of 1,500 acres.

Table 3-29. Unplanned Wildfires in the WRFO Between 2000–2007

Year	Number of Fires	Acres	WFU	WFU Acres
2000	253	20,300	0	0
2001	232	5,100	1	29
2002	91	11,900	1	18
2003	203	3,200	7	1,600
2004	94	9,000	4	8,900
2005	128	3,500	8	3,255
2006	112	1,400	0	0
2007	149	150	1	1
TOTAL	**1,262**	**234,550**	**22**	**13,793**

SOURCE: Wildland Fire Information System 1202 Reports, 2000-2007.

3.5.2 Planned/Prescribed Fire

The 1997 White River RMP provides guidance on using prescribed fire to meet resource objective. More detailed prescribed fire management is described in the WRFO FMP (BLM 1999b). The number and acreage of prescribed fires varies each year based on available funding and weather conditions present to implement each project. Mechanical vegetation treatments are being used as an optional method to prescribed fires to reduce hazardous fuels on the landscape. The uses of mechanical methods in general cost more per acre than prescribed fire and are limited to available funding for implementation.

3.6 Heritage and Visual Resources

3.6.1 Cultural Resources

Cultural resources are recognized as fragile, irreplaceable resources with potential public and scientific uses, representing an important and integral part of our nation's heritage. Cultural resources are contained within a definite location of human activity, occupation, or use identifiable through field inventories (i.e., surveys), historical documentation, or oral evidence (BLM 2004c). Archaeological resources, a subset of cultural resources, describe any material remains of human life or activities that are at least 100 years of age and are of archaeological interest as further defined at 43 CFR 7.3(a). The term "cultural resource" also includes historic or architectural sites, structures, or places with important public and scientific uses, and may include definite locations

(i.e., sites or places) of traditional cultural or religious importance to specified social and/or cultural groups. The BLM defines a definite location as having discernable, mappable, or more-or-less exact limits or boundaries, on a scale that could be established by a survey crew using conventional sensing and recording equipment, by an informant's direct on-the-ground indication, or by precise placement through documentary sources (BLM 2004c).

Resource condition is assessed by field observation, cultural resource inventories, site monitoring, and project review. The primary resource indicator is whether there is a loss of those characteristics that may qualify the property for listing on the National Register of Historic Places or would diminish the cultural value of areas important to Native American or other traditional communities. These characteristics could be affected by physical destruction, damage, or alteration of the resource; isolation of the resource; alteration of setting; neglect resulting in deterioration and destruction; or the transfer, sale, or lease of the resource. Specific indicators include the extent or intensity of natural weathering, erosion, wildfire, ground disturbance, grazing, recreation use, unauthorized collection, intrusions to setting, and vandalism. This loss affects the completeness and accuracy of the scientific information that could be derived from a resource; the aesthetic, historic, or interpretive value of the resource; and/or the importance of the resource in maintaining social and cultural traditions.

Identified Cultural Resources

A variety of cultural resource site types attributed to a range of culturally distinct chronological periods have been discovered in the WRFO Planning Area. These sites range from more than 10,000 years ago to present, and a high potential exists for additional resources to be found. Inventories have historically been implemented to support site-specific surface-disturbing projects, such as mineral and energy development, to comply with the requirements of Section 106 of the National Historic Preservation Act and other cultural resources preservation laws. Additionally, academic institutions have performed research excavations, although such scientific investigations have been limited in scope and areal extent. Implemented in this manner, previous cultural resources inventories have not resulted in the characterization of the variety of environmental and ecological ranges present in the WRFO Planning Area. As a result, known sites do not fully represent the extant cultural resources.

As reported in a recently prepared Class I overview (BLM 2008g), over 5,900 cultural resources localities have been identified in the WRFO Planning Area. Extant cultural resources are classified into site types based on similar physical or cultural characteristics. At the most general level, cultural resource sites are categorized as either prehistoric or historic. Because geographic locations desirable for human use at one time could be desirable for human use at other times, the number of sites (whether historic/prehistoric or within prehistoric cultural affiliations) is not aggregate, as cultural material from one site may be attributable to several time periods.

The majority of the previously recorded sites in the WRFO Planning Area have been identified as prehistoric in age and cultural affiliation. Prehistoric sites could be associated with one or more of four regional cultural traditions: Paleo-Indian, Archaic, Formative (Fremont), and Proto-historic. Documented prehistoric site types include: artifact scatters, open and sheltered camps, quarries, kill sites, rock shelters, rock art, burials, stone circles, wickiups, granaries, and rock walls. Historic sites are cultural resources with a period of significance following A.D. 1880 and are organized thematically. Table 3-30 displays the cultural chronology represented in the WRFO Planning Area.

Table 3-30. Cultural Time Periods Represented in the WRFO Planning Area

Cultural Time Stage	Age Range	Characteristics
Paleo-Indian	Before 6400 B.C.	Big-game subsistence patterns. Numerous projectile points from this period have been recovered, but only one site (Kibridge-Yampa, 5MF3687) has been dated. Paleo-Indian sites are significant due to scarcity.
Archaic	6400–400 B.C.	Nomadic lifestyle with small game hunting, seed, and nut-gathering subsistence patterns. Projectile points and camps have been found and further discoveries are possible. Archaic sites are scientifically important because of the differences between Colorado Plateau/Great Basin Archaic cultures and Northwestern Plains Archaic cultures in the WRFO Planning Area.
Formative	400 B.C.–A.D. 1300	Increased use of bow and arrow, ceramics, rock art, and farming with associated sedentary lifestyle and population growth. As a result, more permanent settlements and associated cultural resources remain from these cultures. Scientific uncertainty still remains concerning their origin and disappearance.
Proto-Historic	A.D. 1300–A.D. 1881	Nomadic lifestyle with hunting-gathering traditions while retaining use of ceramics and small unnotched or side-notched projectile points. Later traits also include equestrian rock art motifs, European trade goods, wickiups, and a possible increase in the use of obsidian.
Historic	After ca. 1880	Euro-American settlement patterns associated with agriculture, homesteading, limited ranching and hay farming, minerals development, and transportation.

SOURCE: Reed and Metcalf 1999.

Current Resource Management

BLM's mandate to manage cultural resources (BLM 2004 c) includes, but is not limited to, the following authorities:

- An Act for the Preservation of American Antiquities (Antiquities Act) of 1906
- Historic Sites Act of 1935
- Reservoir Salvage Act of 1960, as amended by the Archaeological and Historic Preservation Act of 1974
- National Historic Preservation Act of 1966, as amended
- Archaeological Resources Protection Act of 1979, as amended
- Federal Land Policy and Management Act of 1976
- Executive Order 13287 ("Preserve America" 63 FR 43, March 5, 2003)

Since 1965, nearly 8,500 cultural resources surveys have been conducted in the WRFO, with peaks of activity in the 1980s, 1990s, and 2000s, which mirror mineral activity in the region. The investigations have documented more than 5,900 cultural resources. Although these studies have produced a wealth of data on prehistoric and historic occupations in the WRFO, much remains to be learned. Proper management of cultural resources within the WRFO depends on the resolution of data gaps and deficiencies, threats to resources, and sensitivity areas.

The Class I overview (BLM 2008g) has identified the following gaps and deficiencies:

- Subsurface potential—information about buried sites should be integrated with surface data.
- Absence of temporal data—assigning age estimates to site occupations clarifies intra- and inter-site relationships.
- Lack of survey on private lands—private lands are generally exempt from federal laws and regulations protecting cultural resources and, as such, constitute a "hole" in the dataset.
- Lack of tested and excavated sites—surface sites are limited in the amount of information they can provide about the regional culture history.
- Lack of surface visibility—areas obscured by vegetation (especially in the eastern half of the WRFO Planning Area) can obscure cultural resources and restrict interpretations.
- Consistency in NRHP recommendations—care should be taken that systematic biases in evaluating sites for eligibility to the NRHP are minimized and all characteristics of a resource are fully considered.

Threats to cultural resources include, but are not limited to, mineral development and associated road building, timber sales, vegetation thinning and treatment, development of commercial or residential tracts, and wild or prescribed fires.

It has long been understood that some areas are more likely to contain important cultural resources than other areas. Identifying such "sensitive areas" is critical to effective land management, but it is not an easy and/or straightforward process, in many cases because of the data gaps and deficiencies noted above. Using known site data, the Class I overview (BLM 2008g) has identified areas of low, medium, and high sensitivity based upon the distribution of two independent variables, distance to water and slope, which are considered the best predictors of site locations.

Known high site sensitivity areas are found along the southern flank of Blue Mountain, in the Danforth Hills and Piceance Creek Basin, and the area west of the Cathedral Bluffs to the Colorado-Utah state line. The Canyon Pintado NHD is listed on the National Register of Historic Places and is noteworthy as an area with high densities of rock art and archeological sites (see Map 3-18). There are only four sites listed on the NRHP in WRFO. One is Duck Creek Wickiup Village in the MPA area. The remaining three, Collage Shelter, Carrotman Site and Fremont Fortification Site, are located west of the Cathedral Bluffs in the Texas-Missouri, Creek Cottonwood Creek and Douglas Creek drainages, respectively. The medium site sensitivity areas surround the high areas. Low site sensitivity areas encompass the largest part of the WRFO Planning Area, especially in the eastern half.

3.6.2 Paleontological Resources

Paleontological resources, usually thought of as fossils, include the bones, teeth, body remains, traces, or imprints of plants and animals preserved in the earth through geologic time. Paleontological resources also include related geological information, such as rock types and ages. All fossils offer scientific information, but not all fossils offer noteworthy scientific information. Fossils are generally considered to be scientifically noteworthy if they are unique, unusual, rare, diagnostically or stratigraphically important, or add to the existing body of knowledge in a specific area of science. Most fossils occur in sedimentary rock formations. Although experienced paleontologists can generally predict which formations may contain fossils and what types of fossils may be found based on the age of the formation and its depositional environment, predicting the exact location where fossils may be found is not possible (BLM 1998a).

Paleontological resources are integrally associated with the geologic rock units (i.e., formations) in which they are located. If extensive excavation on a certain formation in one geographic area results in significant paleontological resources, a potential exists that excavations throughout the extent of the formation may produce fossil material as well. To date, there are approximately 355 known paleontological localities occur within the WRFO Planning Area. Efforts to fully inventory fossil resources within the WRFO Planning Area have been spotty and limited in scope. The potential for the occurrence of significant paleontological resources is currently determined through the Potential Fossil Yield Classification system (BLM 2008h):

- **Class 1**—**Very Low**. Geologic units that are not likely to contain recognizable fossil remains.
- **Class 2**—**Low**. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.
- **Class 3**—**Moderate** or **Unknown**. Fossiliferous or scientifically geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.
- **Class 4**—**High**. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface-disturbing activities may adversely affect paleontological resources in many cases.
- **Class 5—Very High**. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation.

Paleontological localities are areas of known paleontological resources with defined boundaries, usually associated with excavation and data recovery efforts. Although a comprehensive paleontological inventory has not been carried out for the WRFO Planning Area, government, academic, and private industry personnel have studied paleontological resources in various contexts, but principally in relation to surface disturbing development activities.

Management for Paleontological Resources

The BLM is legally mandated to manage and protect scientifically noteworthy fossils for the benefit of the public, primarily under the auspices of FLPMA and the Paleontological Resources Preservation Act (PRPA) of 2009 (16 U.S.C. 470aaa et seq.). Noteworthy fossils include all vertebrate fossil remains (body and trace fossils) and those plant and invertebrate fossils determined on a case-by-case basis to be scientifically unique.

Management of fossils found on BLM-administered lands is restricted to public surface. Collecting fossils is allowed with some restrictions, depending on the significance of the fossils. Casual collecting of a reasonable amount of common invertebrate and plant paleontological resources may be allowed for non-commercial personal use, either by surface collection or the use of non-powered hand tools resulting in only negligible disturbance to the Earth's surface and other resources. Commercial collecting of fossils is not permitted. Collection of all vertebrate and any administratively designated plant or invertebrate fossils may occur only under permits issued by the BLM to qualified researchers. The basic permit is the survey and limited surface collection permit issued for reconnaissance work and collection of surface finds within an area of 1 square meter. If the disturbance exceeds 1 square meter or requires mechanized equipment, the researcher must apply for an excavation permit. All paleontological resources collected under a permit remain public

property and must be curated in an approved repository according to Sec. 6304 of the PRPA. Prior to authorization of an excavation permit, and in some cases for survey permits in management areas, the BLM must prepare an EA for the proposed location. All fossils collected under a permit remain public property and must be curated in an approved repository according to BLM Manual 8270, Paleontological Resource Management.

Management actions pertaining to paleontological resources are incorporated in the alternatives and described in more detail in Chapter 2.

3.6.3 Visual Resources

The purpose of visual resource management is to manage the quality of the visual environment and reduce the visual impact of development activities while maintaining the viability of all resource programs. Visual resource management involves evaluating landscapes and determining appropriate techniques and strategies for maintaining visual quality and reducing adverse impacts. The BLM developed the Visual Resource Management (VRM) system to identify and evaluate an area's scenic values to determine the appropriate management objectives for those values. A summary of the BLM VRM program is below.

- The VRM system is a two-part process involving an inventory phase and an analysis (RMP) phase.
- Lands have different visual values that warrant different management.
- The Visual Resource Inventory (VRI) process identifies and evaluates visual values that are considered throughout the resource management planning process.
- The results of the VRI are inventory classes that are incorporated into the RMP process and assigned to VRM management classes with established objectives.
- Visual resource values are considered along with all other multiple resource values during the RMP process to determine VRM classes; management decisions reflect a multidisciplinary analysis.
- VRM classes established by the RMP provide guidelines for the design and construction of all surface-disturbing activities.
- Proposed projects are analyzed using the contrast rating process to determine if VRM class objectives are met and to identify design adjustments and/or mitigation measures to minimize visual impacts.

Visual Resource Management Classes

The four VRM class objectives are as follows:

- **Class I**. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
- **Class II**. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

- **Class III**. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Class IV**. The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Visual Resource Management within the WRFO Planning Area

A field office-wide VRI was completed for the WRFO in late 2011. The BLM's VRM system was used to inventory and classify the scenic resources across the entire field office. The VRI identified the scenic quality, sensitivity levels, and distance zones and also determined VRI classes, according to the VRM manual, for use as baseline information in the development of a future RMP revision. Since VRI classes are informational in nature and do not establish management direction and this Oil and Gas RMPA does not include any new designations or classifications, the VRI is used only for discussion and illustrative purposes. As such, any impacts from future oil and gas development are analyzed against the current VRM classes and objectives that have been retained from the 1997 White River Resource Area Record of Decision and Approved RMP.

The management objectives set forth in the 1996 White River Resource Area Proposed RMP/Final EIS provide the visual management guidelines for the design and development of future projects and for rehabilitation of existing projects (BLM 1996). Management objectives for visual resources are met by classifying the landscape into one of four VRM Classes. Table 3-31 lists the VRM class acreage in the WRFO Planning Area.

Table 3-31. VRM Class Acreage in the WRFO Planning Area (BLM Ownership)

VRM Class	Acres
I	39,400
II	412,300
III	861,700
IV	146,100

SOURCE: BLM 1996.

Sixty-nine percent of the WRFO Planning Area is designated as VRM Class III and IV. Landscapes in these areas possess a combination of characteristics ranging from low scenic quality and low visual sensitivity. These areas may remain relatively unseen by the public due to accessibility or obstructed views. The VRM Class I areas (approximately three percent of the WRFO Planning Area) are associated with Wilderness Study Areas recommended for wilderness designation. These areas are north of the town of Dinosaur and are referred to as Bull Canyon, Willow Creek and Skull Creek WSAs. Table 3-32 displays the VRM classes associated with major oil and gas production fields within the WRFO Planning Area. Twenty-eight percent of the WRFO Planning Area is designated as VRM Class II areas.

Table 3-32. VRM Classes Associated with Major Oil and Gas Production Fields

Major Oil and Gas Production Area	VRM Class
Rangely	III and IV
Wilson Creek	II and III
Douglas Creek Arch	IV
Piceance Creek Basin	III

SOURCE: BLM 1996.

The value of the visual landscape and its historic and scenic areas has been formalized by establishment of the Dinosaur Diamond National Scenic Byway Corridor and the Canyon Pintado NHD. The Dinosaur Diamond National Scenic Byway traverses the western portion of the WRFO Planning Area along SH 139 and SH 64, passing through the towns of Rangely and Dinosaur (Dinosaur Diamond Partnership, Inc. 2000). The Dinosaur Diamond National Scenic Byway Corridor Management Plan strives to "…enhance, promote, and protect the dinosaur fossil and archaeological resources of the…Highway". The Plan sets forth recommendations and objectives to achieve its vision. The BLM was a cooperating agency in the development of the Plan. Motorists traveling along the National Scenic Byway are likely to be more sensitive to visual contrasts due to the expectation travelers place on scenery along a National Scenic Byway.

The Canyon Pintado NHD is listed on the NRHP. The District is located in the Douglas Creek Valley, between Rangely and Fruita on SH 139. The District is noteworthy as an area with high densities of rock art and archeological sites. It represents a destination attraction in the WRFO Planning Area and is a more sensitive area in terms of visual contrast. The District coincides with that portion of the Dinosaur Diamond National Scenic Byway along SH 139, south of Rangely. The BLM has developed an interpretive plan for the District.

Visual Resource Conditions

During the last five years, domestic energy policy and demand have created a favorable environment for oil and gas development. As a result, there has been an increase in the appearance of equipment and infrastructure associated with that industry in the WRFO Planning Area.

Although oil and gas development is part of their cultural heritage, the communities of Rangely, Meeker, and Dinosaur may be sensitive to additional visual impacts from highly visible infrastructure. Activities that could result in visual impacts could include additional electric transmission lines, infrastructure along ridge tops, or road cuts in hillsides. The BLM recognizes aesthetic value in the landscape and considers visual resources when planning land use activities.

Public concerns, including the quality of recreational opportunities on public lands, scenic values and scenic quality, and the costs to develop mitigation, present management challenges for the BLM. Other management challenges related to VRM include the increase in energy development on public lands, overlap of National Historic Sites and utility corridors, effective mitigation along travel routes including Scenic Byways, data supporting the validity of current VRM classes within the WRFO Planning Area, and monitoring the long-term impacts of management standards and practices.

3.7 Resource Uses

3.7.1 Forest Products

Timber resources within the WRFO Planning Area consist of small stands of ponderosa pine, Douglas fir, lodgepole pine, aspen, and an aspen/conifer mix. Woodland areas are dominated by pinyon pine and juniper species that are not traditionally used in commercial wood product markets. However, pipelines and other development projects that necessitate removal of these woodlands are treated as commercial harvest. From 2006 through 2008, 850 acres of pinyon/juniper woodlands have been harvested in this manner. Traditional wood products harvested in Colorado include sawtimber, firewood, Christmas trees, post and poles, and biomass. Forest lands in Colorado have low productivity rates, and BLM manages lands to maintain forest health conditions rather than produce commercial timber. The forest and woodland resources within the WRFO Planning Area are shown on Map 3-2.

3.7.2 Livestock Grazing

The WRFO administers livestock grazing on 154 grazing allotments (Map 3-13) totaling approximately 1,954,100 acres. These grazing allotments contain 1,445,300 acres of public land that are permitted for 124,619 animal unit months (AUMs). The WRFO permits livestock grazing for cattle, sheep, and horses.

The season of use for each allotment varies but most are a combination of spring, summer, or fall. Winter use generally occurs in the lower elevation desert and pinyon/juniper allotments which are often utilized in the spring and fall, too. Most of the livestock grazing permits in the WRFO Planning Area are for cattle operations that run cow/calf pairs. Calving generally occurs on private land before operators move into an allotment.

Forage production fluctuates between years based on precipitation, and actual use AUMs fluctuate accordingly. Reduced use is activated when adverse weather conditions suppress plant growth and carryover forage is not available, such as in 1987 to 1994 and in 2002 to 2004. Authorized AUMs are more fully activated after several years of favorable weather restore forage and water availability. Total permitted numbers of AUMs, livestock classes, and seasons of use change frequently due to conversions of the class of livestock and changes in allotment or livestock management, range improvements, and vegetation manipulations. Adjustments in livestock grazing levels, as a result of changes in available forage or permit renewal application, follow procedures outlined in 43 CFR 4110.3.

Rangeland Health and Productivity

In the 1997 White River RMP grazing allotments were placed into one of three management categories that define the intensity of management and concentrate funding and on the ground management efforts on those allotments where actions are most needed to improve the resources or resolve serious resource conflicts (BLM 1997a). Each grazing allotment fits into one of three management categories that define general rangeland management objectives: (1) improve; (2) custodial; and (3) maintain.

Allotment Management Plans (AMPs) provide greater detail in terms of livestock management objectives than the terms and conditions in the general grazing permit or lease. The AMPs are generally prioritized for those allotments designated for improvement but can also be developed for allotments in the maintenance or custodial categories.

Minimum rest periods have been identified for most allotments where no livestock grazing occurs for a period of time to restore plant vigor, improve watershed conditions, and improve rangeland health according to the Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (BLM 1997b).

The Colorado Standards for Public Land Health describe the desired conditions needed to sustain public land health. These standards relate to all uses of the public lands and are applied on a landscape scale. The Guidelines for Livestock Grazing Management are a subset of the Standards for Public Land Health, developed to help livestock managers promote progress toward the Standards. If it is determined that livestock grazing is the cause of any grazing allotment failing to meet or to show significant progress toward achieving the Standards for Public Land Health, then the authorized officer would recommend changes in livestock management practices within that allotment as per 43 CFR 4180.2(c).

Rangeland Monitoring

Active grazing use authorization, management actions, and long term rangeland health in each allotment are monitored and evaluated, based on existing data. Adjustments are made by agreement or decision in accordance with legislation, regulations, and policy to ensure that public land resources are maintained or improved for future commodity and non-commodity values. Resource specialists use a variety of tools to monitor rangeland health including a series of rangeland health indicators that help them make determinations regarding the relationship between livestock grazing and the Colorado Standards for Public Land Health. The current evaluation schedule is based primarily on allotment management categorization (WO-IM-2009-007), resource concerns, and permit expiration dates.

Most livestock operators have worked in the WRFO Planning Area for generations and have specific knowledge of the issues within their grazing allotments. This information is useful in livestock management planning and livestock operators are encouraged to participate in monitoring, developing rangeland improvement projects, and reclamation activities.

3.7.3 Minerals

Mineral resources in the WRFO Planning Area include leasable (oil and gas, geothermal, coal, and other solid leasables), locatable, and salable minerals. Each individual resource section below includes a definition and description of the resource, the current condition of the resource, management challenges, and management actions. Management actions are incorporated in the alternatives and described in more detail in Chapter 2.

3.7.3.1 Leasable Minerals

Oil and Gas

Most of the WRFO Planning Area is contained within two USGS petroleum resource assessment provinces: the Uinta-Piceance Province and the Southwestern Wyoming Province. Regionally, the WRFO Planning Area is situated near or along the northern and northeastern boundary of the Uinta-Piceance Basin with about 86 percent of the field office area included in this province. A small portion of the easternmost part of the WRFO Planning Area is within the Greater Green River Basin portion of the Southwestern Wyoming Province and covers less than two percent of the WRFO Planning Area. This small portion of the Greater Green River Basin is characterized by relatively low hydrocarbon potential, extremely sparse well control (i.e., a single dry hole), very few existing

oil and gas leases, and an absence of drilling activity during the last 50 years. Appendix H contains a description of the processes for oil and gas operations within the WRFO.

The term "Piceance Basin" has been used interchangeably to describe structural, depositional, and surface drainage basins in this portion of northwestern Colorado. The geological features of the Piceance Basin are described in Section 3.1.2, Geology.

Historical Activity

The WRFO Planning Area has historically been explored for more than 100 years, commencing in the late 1800s and extending to the present day. Today, the WRFO Planning Area contains almost 5,800 existing boreholes in more than 60 proven fields. A comprehensive discussion of historical activity up to the 1990s can be found in the 1997 White River RMP.

In the nearer term commencing in the 1990s and extending to the early part of the 2000s, about half of the total drilling was concentrated in the Douglas Creek Arch with an overall success rate of more than 85 percent. Development drilling continued in the Rangely Oil Field and this activity accounted for only five percent of the total wells spudded during this period. This significant decline in activity was slightly offset by the increased success rate (86 percent) attained in the field.

Other significant operations included the 1991 discovery of deeper gas reserves in the Mesaverde Group (Williams Fork Sandstone and the Cameo Coal Zone) at the White River Dome Field. As stated in the Present Activity section below, the majority of the wells to be drilled in the next 20 years would be constructed in the low permeability Mesaverde Group. The Mesaverde is present at depths of 8,500 to 16,500 feet.

Subsequent infill drilling of both Wasatch and Mesaverde reservoirs in this area represented about ten percent of the total new wells drilled in the WRFO Planning Area during the 1990s and early 2000s. A similar level of drilling activity was observed in the Piceance Creek Drainage Basin, where operators targeted both stratigraphically trapped shallow Wasatch sand reservoirs and deeper Mesaverde tight gas sand accumulations. More than half of this activity involved exploratory drilling and about two-thirds of the wildcat penetrations were completed in the region around the turn of this century.

Map 1-4 shows the location of the producing wells. Current production volumes and comparison to future activities are discussed under Present Activity below. Producers can drain typically 1.3 billion cubic feet (bcf) of gas per well using multistage hydraulic fracturing (frac) techniques on downhole spacing of 10 acres. The reason the wells can drain such a volume of gas is that the reservoir consists of a series of vertically stacked sandstone intervals with a total thickness ranging from 1,500 to 2,000 feet. As a result, future wells would likely produce similar volumes to current wells. Less than five percent of future wells would be drilled to oil targets.

Present Activity

Beginning in 2004, the WRFO Planning Area has undergone a dramatic increase in drilling activity. Roughly 70 percent of the current operations are centered in the Piceance Creek Drainage Basin (focused on the thick, gas-saturated Mesaverde tight sand play), about 20 percent in the Douglas Creek Arch area (primarily drilling Cretaceous sand, shale, and coalbed gas reservoirs), and the remaining ten percent in the Rangely Field (targeting the Weber oil sand). The emerging interest in the Mesaverde basin-centered play in the central part of the WRFO Planning Area (the Mesaverde Play Area) is principally related to the development of new completion technology (i.e., modern hydraulic frac techniques) coupled with the sustained elevation in gas prices (greater than

$5.00/thousand cubic feet of gas) over the past few years. Operators have aggressively pursued both exploration and development drilling activities in the Piceance Creek area. Exploratory outpost or new field wildcat wells account for roughly 30 percent of the wells drilled in this region, with an average success rate of 88 percent over the past four years. The remaining 70 percent of the penetrations drilled in the Piceance Creek area were infill development wells and nearly all (97 percent) of these boreholes have been successfully perforated and completed. In the Douglas Creek Arch area, overall drilling activity is currently in decline and this is probably in response to difficulties in the effective disposal of high volumes of produced water in this maturely developed part of the northern Piceance Basin. Since 2004, exploratory drilling has represented only about ten percent of the recent wells spudded in this westernmost region, and operators have attained nearly a 90 percent average success rate in drilling these "riskier" opportunities. Most of the wells drilled on the Douglas Creek Arch; however, have been infill development penetrations; these exploitation programs have achieved an average success rate of about 96 percent. Lastly, the Rangely Field has been characterized by an absence of exploratory activity. Development operations on the anticline have also continued to steeply decline. Relatively few development wells (fewer than 30) have been drilled since 2004 but nearly all of them (94 percent) were successfully perforated and completed. Although limited future activity is anticipated for the Rangely Field, enhanced recovery operations (carbon dioxide and water injection methods) would continue to help sustain the production of liquid hydrocarbons from this world-class accumulation.

Well and production summaries were generated from the Colorado Oil and Gas Conservation Commission database for the WRFO Planning Area. Approximately 5,800 wells have been drilled in the area as a result of exploration and development activities: 1,806 producing wells, 317 injection wells, 12 water disposal wells, more than 2,500 plugged and abandoned wells, 271 shut in wells, 65 temporarily abandoned wells, and 36 wells waiting on completions (COGCC 2006). The 1,806 producing wells produced a total of 47,716,491 barrels of oil and 273,602,232 thousand cubic feet of gas from 1999 to 2006 (COGCC 2006). Table 3-33 shows the oil, gas, and water produced for that eight-year period. Oil production has declined over the eight-year period, while gas production and the produced water volume have increased over the same time period, primarily as a result of bringing new Mesaverde natural gas wells online in the last two years of the period.

Table 3-33. Oil, Gas, and Water Produced in the WRFO Planning Area from 1999 to 2006

Year	Oil (Barrels)	Gas (MCF)[(1)]	Water (Barrels)
1999	6,651,586	27,936,756	96,858,745
2000	6,514,386	31,136,487	96,373,175
2001	6,237,208	31,372,895	95,347,723
2002	5,884,964	35,920,570	89,841,114
2003	5,604,271	34,126,800	85,177,701
2004	5,511,331	33,430,676	97,877,565
2005	5,675,879	36,594,928	101,297,487
2006	5,636,866	43,083,120	105,021,318
Total	47,716,491	273,602,232	767,794,828

SOURCE: COGCC 2006.
NOTE:
[(1)]MCF = 1,000 cubic feet

Because the obvious and easily identifiable structural traps have been drilled, future exploration in the WRFO Planning Area would likely focus on stratigraphic traps and drilling to depths up to 16,500 feet within the areas identified as having potential for oil and gas production (BLM 1994). The majority of the future wells would be constructed for gas production from the low permeability Mesaverde Group. New development would likely occur based on exploratory drilling programs now being implemented within the WRFO Planning Area.

Exploration for coal bed natural gas began in the Piceance Basin during the early 1980s. Commercial production was finally achieved in 1989 in the Parachute Field, operated by Barrett Resources. Other operators soon followed, including Fuelco at White River Dome Field in the northern part of the basin, and Conquest Oil Company near Barrett Resources' production in the central part of the basin. However, not all operators were successful in locating or producing coal bed natural gas. Ultimately, Barrett found the sandstones to be far more productive than the coal beds, and attempts to complete the wells in the coalbeds were abandoned (EPA 2004).

As shown on Map 1-4, in general, "high" potential areas are defined by the presence of proven source and reservoir-quality rocks that have experienced a favorable thermal maturation history for the generation and trapping of significant hydrocarbon accumulations. "Moderate" potential areas are those characterized by geophysical or geological indications of the presence of source and reservoir-quality rocks that may have undergone a favorable thermal maturation history for the generation and trapping of hydrocarbon accumulations. "Low" potential areas possess an absence of one or more of the previously described variables (e.g., source rocks, reservoir rocks, thermal maturation, and trap presence). Areas of "no known" or "no" hydrocarbon occurrence potential are those with an absence of source rock, reservoir rock, thermal maturation, and trap presence, essentially excluding the occurrence of hydrocarbons in a particular area.

The map presented in the 2007 RFD for potential oil and gas occurrence shows that most (approximately 77 percent) of the WRFO Planning Area has a moderate to high potential of encountering hydrocarbon-bearing rocks in the subsurface. Only the two major tectonic uplifts in the WRFO Planning Area, the Yampa Plateau and White River Uplift, are characterized by lesser hydrocarbon occurrence potential. Most of the unleased federal mineral estate occurs in these two regions. To the northwest, the Yuma Plateau structural uplift exhibits a relatively limited stratigraphic column of primarily Paleozoic and older rocks. Only a single USGS Uinta-Piceance Assessment Unit extends into this region. The White River Uplift in the eastern part of the study area also possesses a thin section of Paleozoic sedimentary rocks, sometimes unconformably overlain by Tertiary rocks of volcanic origin, and a single Assessment Unit extends into this region of lesser occurrence potential. Historically, these two areas of limited potential hydrocarbon occurrence in the WRFO Planning Area have demonstrated relatively low levels of drilling activity and an absence of significant commercial hydrocarbon production.

Geothermal

The BLM and the National Renewable Energy Laboratory (NREL) issued a report in 2003 that identified public lands most suitable for increased development of renewable energy, including geothermal resources. Findings of the report indicated that the WRFO Planning Area was not among the 25 highest rated areas for potential development of geothermal power. The BLM studies indicated that the WRFO Planning Area is not considered to have high potential for geothermal power development.

Coal

Coal potential exists in two major fields in the WRFO Planning Area under current economic conditions. The Danforth Hills Field north of Meeker contains an estimated 416 million tons of recoverable coal reserves. The White River Field is in the general vicinity of Rangely and contains an estimated 327 million tons of recoverable coal reserves. The main coal-bearing beds in both fields are the Iles and Williams Fork Formations of the Upper Mesaverde Group (BLM 2007b). Deserado Mine is currently producing coal in the White River Field near Rangely. The Colowyo coal mine is located in the Danforth Field. Active mining is north of the WRFO Planning Area in Moffat County and is administered by the Little Snake Field Office. Although grading from the open pit mine extends into Rio Blanco County, no additional coal extraction is projected for the WRFO Planning Area under current economic conditions.

Map 1-3 shows the locations of the White River and Danforth Hills coal field areas and acreage designated as either suitable or not suitable for coal leasing. The coal lease areas are designated as: suitable for both surface and subsurface coal mining, suitable for subsurface but not surface mining, or not suitable for either surface or subsurface coal mining.

Several closed coal mines in the Danforth Hills Field have the potential to reopen if the economics become favorable. Future coal mining activities are likely in the WRFO Planning Area based on market-driven prices of coal, transportation and the desire to reduce dependency on foreign oil.

Other Solid Leasables

Other leasable minerals within the WRFO Planning Area include sodium and oil shale. Uranium, bentonite, gypsum, limestone, and other "hardrock minerals" occurring on acquired public lands not closed to mineral leasing can be developed only under a leasing system. Access to the leasable federal mineral estate is at the BLM's discretion.

Sodium

The Piceance Basin contains the world's largest and most economically significant nahcolite resource (naturally occurring sodium bicarbonate). Most of the significant deposits of oil shale and all of the sodium resources are found in the Parachute Creek Member of the Green River Formation.

The sodium resource in the basin was estimated at 32 billion short tons (Dyni 1974) and 29 billion tons (Beard et al. 1974).

There are presently eight sodium leases, approximately 16,600 acres, on BLM land in northwestern Colorado (BLM 2006d). Solution mining operations have been constructed on two of these leases in Rio Blanco County. One solution mining operation was mothballed in 2004 due to market issues. The other mine has been operating since 1991 and produces approximately 90,000-100,000 tons of sodium bicarbonate annually. The sodium deposits located in the WRFO Planning Area are shown on Map 3-15.

Future development of sodium resources is likely in the WRFO Planning Area. The development would depend on the results of continued improvement of solution mining technology, and market-driven prices of sodium bicarbonate.

Oil Shale

Oil shale is prevalent in the western states of Colorado, Utah, and Wyoming. The resource potential of these shales is estimated to be the equivalent of 1.5 to 1.8 trillion barrels of oil in place (Bartis et al. 2005). Resource potential within the Piceance Basin totals approximately 1.0 trillion barrels of

oil in place (Smith 1980). The Parachute Creek Member of the Green River Formation contains most of the oil shale. The Parachute Creek Member is 900 to 1,200 feet thick at the southern and western margins of the basin and nearly 1,900 feet in the depositional center. The Mahogany zone (Parachute Member) consists of kerogen-rich strata and averages 100 to 200 feet thick. This zone extends to all margins of the basin and is the richest oil shale interval in the stratigraphic section.

The area available for oil shale leasing in the WRFO Planning Area is shown on Map 3-15. Because oil shales have not proven economically recoverable, they are considered a contingent resource. High-grade oil shale in the area contains more than 25 gallons of oil per ton of shale (Dyni 2003).

Federal interest in oil shale dates back to the early 20th century, when the Naval Petroleum and Oil Shale Reserves were set aside. After a second oil embargo in the 1970s, Congress created a synthetic fuels program to stimulate large-scale commercial development of oil shale. A number of commercial-scale oil shale mining and retort projects were initiated in the WRFO Planning Area after the second embargo. The federal program proved short-lived, and commercially backed oil shale projects ended in the early 1980s when oil prices began declining. Attempted development of the oil shale has occurred at prototype lease Tracts C-a (5,100 acres) and C-b (5,100 acres). Tract C-a was leased to show feasibility of open pit mining techniques and Tract C-b was leased to be developed as an underground mining operation with above ground retorting of the oil shale. Tract C-a has been reclaimed and relinquished and Tract C-b has been reclaimed and is in the process of being relinquished.

No mining method yet applied has provided a viable method for the profitable extraction of shale oil. However, with economic and potential crises bringing periodic renewed interest, oil shale would continue to be regarded as a valuable potential resource.

Interest in commercial development of oil shale revived with the current higher oil prices and, in August 2005, the U.S. Congress enacted the Energy Policy Act of 2005, Public Law 109 58. In Section 369 of this Act, also known as the "Oil Shale, Tar Sands, and Other Strategic Unconventional Fuels Act of 2005," Congress declared that oil shale and tar sands (and other unconventional fuels) are strategically important domestic energy resources that should be developed to reduce the nation's growing dependence on oil from politically and economically unstable foreign sources. In early 2005, the BLM solicited the nomination of parcels to be leased for RD&D of oil shale recovery technologies in Colorado, Utah, and Wyoming. Three companies are in the process of demonstrating new technology on five BLM 160-acre RD&D lease tracts in the Planning Area. If RD&D technologies are proven to be technically, economically, and environmentally feasible, the RD&D leases may be converted to 5,120-acre commercial oil shale leases.

In the second round of leasing, the RD&D parcel is again 160 acres but the associated preference lease area has been reduced to an additional area of up to 480 contiguous acres. The preference lease area is an area that can be reserved for conversion to a commercial lease at a future time after additional BLM review. There are currently two proposals being considered by the WRFO during this second round of RD&D leasing. Development of commercial oil shale operations would be dependent on the cost of recovering oil from the oil shale and the price of oil.

3.7.3.2 Locatable Minerals

Locatable minerals is a legal term that, for federal lands in the U.S., defines a mineral or mineral commodity that is acquired through the General Mining Law of 1872, as amended. These are the base and precious metal ores, ferrous metal ores, and certain classes of industrial minerals.

Acquisition of locatable minerals is by staking a mining claim (location) over the deposit and then acquiring the necessary permits to explore or mine. Examples of locatable minerals include, but are not limited to, gold, silver, platinum, copper, lead, zinc, magnesium, nickel, tungsten, bentonite, barite, feldspar, uranium, and uncommon varieties of sand, gravel, and dimension stone. Uncommon variety minerals are deposits that have distinct and special properties making them commercially valuable for use in manufacturing, industrial, or processing operations.

The BLM manages the Mining Law program on the federal mineral estate (Map 3-14), including management such as authorizing and permitting mineral exploration, mining, and reclamation actions. For operations other than casual use, the claimant is required to submit a notice or a plan of operations. Regulations require the claimant to prevent unnecessary or undue degradation of the land. Management actions may recommend closures to mineral entry by withdrawing areas from further location of mining claims or sites and may apply restrictions needed to protect other resource values when conducting activities under the operation of the mining laws.

Within the WRFO Planning Area the rock formations are primarily sedimentary in origin and are not a likely source for significant deposits of locatable minerals such as precious metals (e.g., gold or silver). There are no current or past mining areas in the WRFO Planning Area associated with precious metal or other locatable metal minerals other than uranium, discussed below.

Uranium is designated as a strategic locatable mineral. Interest in uranium exploration has been cyclic and is influenced by war, the threat of war, shortages, temporary surpluses, poor planning, and a fear of environmental hazards. To date there has not been any development of potential uranium reserves within the WRFO Planning Area. However, with uranium prices going up, interest in uranium exploration in the WRFO Planning Area has recently started to increase. Uranium mining claims have been staked recently in the northwestern portion of the WRFO Planning Area north of Rangely near U.S. 40. Several claims have been staked encompassing approximately 44 square miles within two separate blocks of claims south of U.S. 40.

3.7.3.3 Salable Minerals

Salable minerals, also known as mineral materials, include common variety materials such as sand, gravel, stone (e.g., decorative stone, limestone, and gypsum), clay (e.g., shale and bentonite), limestone aggregate, borrow material, clinker (scoria), and leonardite (weathered coal). Of the salable minerals, only sand and gravel are found within the WRFO Planning Area.

Sand and gravel provide raw materials for most construction and paving activities. Sand and gravel deposits are found along the White River and major tributary valleys. Other sources include widespread colluvial deposits at the base of rock outcrops, and alluvial fans. Large sand and gravel reserves occur near Meeker in the vicinity of Agency Park, and in the Little Beaver area.

With the projected increase in oil and gas activities over the next 20 years, the need for additional sand and gravel resources for road improvements and other construction-related activities would likely increase.

3.7.4 Recreation

The planning area for recreation includes all public lands within the WRFO. Public lands provide a broad spectrum of recreation opportunities and beneficial outcomes, affording visitors an array of settings for primitive and dispersed recreation, as well as developed and OHV-based recreation. Recreational opportunities are available to the public on all BLM-administered lands where legal

access exists. Recreational activities are typically dispersed and unstructured, and include OHV riding and mountain biking, camping, hiking, horseback riding, and target shooting.

Steady population growth, especially around Rangely and Meeker, has placed an increasing recreational demand on adjacent undeveloped public lands as visitors and nearby residents seek a diversity of recreational opportunities. Colorado's population has grown significantly in the past ten years (U.S. Census Bureau 2002), and an increasing number of people are living near or seeking undeveloped public land for recreational use. Much of the future anticipated population growth within WRFO can be attributed to the expected increase in oil and gas development activities as employees and their families relocate to the area. Many of these new residents will naturally place an additional recreational demand on public lands within the WRFO. Section 3.10.1, Economic, Social and Environmental Justice, describes in greater detail the current and projected population increases in the region that may contribute to increased recreational use of BLM administered lands in the WRFO. In addition, Colorado remains a popular destination for tourists, especially those seeking experiences in an undeveloped setting. As a result, public lands administered by the BLM are absorbing increasing recreational use.

In addition to the local population and visitation increases, oil and gas development has also created new roads, some of which may be available for those seeking recreational opportunities or pursuits, opening up areas that may have once been isolated. This has occurred primarily in the Piceance Basin.

Recreational settings range from backcountry (e.g., the Willow Creek WSA area) to rural (Rangely). As outlined in the 1997 White River RMP, recreation on BLM land in the WRFO Planning Area is managed as the White River Extensive Recreation Management Area. Specific management regulations can be developed in project plans, or integrated activity plans. Resources would be managed and monitored to ensure protection of sensitive resources and continued availability of recreation opportunities and experiences. Recreation management of the White River ERMA has been primarily custodial, enabling visitor's opportunities for dispersed recreation settings and OHV-based recreation experiences. This type of setting is typical of an area that is largely undeveloped and where nature-based recreation predominates.

Recreation Opportunity Spectrum

Recreation Opportunity Spectrum classes are designated by BLM to establish management objectives related to the type of recreation setting and opportunities to be maintained. The BLM classifies land using one of the six ROS classifications, including primitive, semiprimitive nonmotorized, semiprimitive motorized, roaded natural, and rural. The urban ROS classification does not typically require BLM management restrictions. The primitive, semiprimitive, and roaded natural classifications are designed to provide certain types of recreation settings and may require restrictions on use to meet management objectives.

Recreation Opportunity Spectrum inventories were completed for some portions of the WRFO Planning Area as part of the 1996 White River Resource Area Proposed RMP/Final EIS. The northern Blue Mountain area (formally known as the Blue Mountain Geographic Reference Area) includes semi-primitive non-motorized, semi-primitive motorized, rural natural and rural class settings. The southern Blue Mountain area includes primitive, semi-primitive non-motorized, semi-primitive motorized, rural natural and rural class settings. The White River ACEC includes rural natural and rural class settings (BLM 1996).

Current Recreation Management

Monitoring and enforcement of dispersed recreation is limited, especially in areas with a small percentage of public lands or limited access. The BLM places signs to identify public and private land boundaries, interpret resources, and provide regulatory and informational kiosks in high use areas. Detailed information is available to the public through informational pamphlets, land-ownership maps, and online websites.

Recreational activities in the WRFO Planning Area are varied and include hunting, fishing (cold and warm water), boating (open canoeing and rafting), camping, hiking, backpacking, mountain biking, and OHV use.

The White River ERMA supports elk, mule deer, coyote (*Canis latrans*), bear, and mountain lion hunting. Hunting is the most prominent recreational use and occurs throughout the WRFO Planning Area. The fall hunting season is the busiest time of the year. Many hunters use the BLM road network to reach their hunting areas. Some hunting opportunities exist in specific and limited areas within the WRFO Planning Area, such as the North Fork White River area. Hunting is available in many areas of the Planning Area, and CPW manages hunting primarily through licensing and law enforcement, and GMUs within the Planning Area. CPW also provides and enforces state rules and regulations. However, the BLM issues Special Recreation Permits (SRPs) to hunting and fishing outfitters to operate within the WRFO Planning Area. Areas which are open to OHV use support the hunting that occurs on public land, although OHV use is also associated with other recreational pursuits. Many areas that are closed or limited to OHV use also support hunting experiences, in a more dispersed and backcountry setting. Executive Order 13443 Facilitation of Hunting Heritage and Wildlife Conservation was signed on August 16, 2007. The order directs federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management to evaluate the effect of their actions on trends in hunting participation and to facilitate the expansion and enhancement of hunting opportunities and management of game species and their habitat.

Fishing is common on the White River, Lake Avery, Meadow Lake, Trappers Lake, and Vaughn Lake. Fishing may occur on Douglas Creek and Piceance Creek.

Approximately 200 miles of mountain biking trails are available for use, and many other recreational opportunities follow established dirt and paved roads. Rangely Loop, Dinosaur, Ute, Dominguez-Escalante, Scenery Gulch, Cathedral Bluffs, China Wall, Lion Canyon, and Lobo Mountain trails are some of the motorized and non-motorized trails available for use on BLM-administered land.

The WRFO, in coordination with the Town of Rangely and local organized off-road groups, has designated a 525-acre rock-crawling area southwest of Rangely. This area is managed in partnership between the Town of Rangely, Rangely Rock Crawling Club, and the WRFO. Rock crawling is an emerging OHV sport in which highly modified vehicles are driven over particular geologic features to provide a challenging experience for off-road enthusiasts. The large number of rock outcroppings in the area appeal to enthusiasts of this sport, and subsequently there are a high proportion of participants for this sport in this area (BLM 2006e).

The WRFO administers SRPs to manage organized commercial and noncommercial recreation activities. Special Recreation Permits are issued to accommodate five categories of recreational use, as follows: commercial, competitive, individual or group use in special areas, organized group activity, and event use. Permits may be issued for periods of up to ten years, but lengths of permits

depend on the activities proposed, areas in question, and the past record of the potential permittee. Some SRP activities, especially larger ones that may draw large numbers of participants, may include vending permits, where applicable. Within the WRFO Planning Area, on BLM land, nearly all SRPs are issued for big game hunting.

Areas of high interest to recreational users include Blue Mountain, White River ACEC, Canyon Pintado NHD, and Dinosaur Diamond National Scenic Byway. Specially designated areas provide primitive recreation settings for hiking, nature study, and wildlife viewing. The Blue Mountain area and the White River ACEC are managed in part to provide specific recreation activity opportunities and settings for targeted recreation experiences, such as trophy big game and upland bird hunting, mountain biking, scenic viewing, horseback riding, pleasure driving, wildlife viewing, hiking and backpacking, river float-boating, fishing, and camping. The ACECs are discussed further in Section 3.8.1, Areas of Critical Environmental Concern and Other Management Areas.

There are many opportunities for cultural and archaeological oriented recreation in the WRFO Planning Area, namely in Canyon Pintado NHD. The Canyon Pintado NHD, a property listed on the NRHP, is located in northwestern Colorado in the Douglas Creek Valley, between Rangely and Fruita on SH 139. Examples of rock art from prehistoric cultures are located throughout the canyon.

The WRFO Planning Area includes a portion of the Dinosaur Diamond National Scenic Byway, a major attraction to the area. National Scenic Byways are designated by the Federal Highway Administration based on their archaeological, cultural, historic, natural, recreational, and scenic qualities.

Recreational Use Patterns

Indicators to measure trends in recreation include visitor use levels, user conflict levels, impacts to resources, and compliance with commercial authorization. Recreation use overall is likely to increase, especially motorized-based recreation. This could increase the frequency of visitation to other recreation pursuits, such as interpretive recreation at cultural sites.

Concentrated camping use is increasing across the WRFO Planning Area during the fall hunting seasons, and in the spring and summer, when OHV use is most common. The recreational setting and opportunities surrounding towns and roads may contrast sharply with the settings and opportunities available in remote areas. With the increased residential and commercial development occurring around some towns in the WRFO, many recreation settings have changed from isolated to a more front-country setting. These areas are popular and may receive year-round use. Recreation use overall is likely to increase, especially motorized-based recreation. The need for OHV management tools and active OHV management is becoming increasingly obvious. Current available data on visitation shows an increase since the 1996 White River Resource Area Proposed RMP/Final EIS (BLM 1996). The WRFO is currently monitoring recreation use to update visitation trends. All visitors to BLM lands are expected to adhere to federal regulations and to use "leave no trace" ethics.

Past recreation trends have predominately favored hunting and fishing. However, OHV use in the WRFO has been gaining in popularity in the last ten years as all-terrain vehicles (ATVs) become safer and more affordable. These trends are expected to continue to increase as population of the surrounding areas continues to expand. The U.S. Census Bureau predicts an increase of 1.5 million residents to the State of Colorado by the year 2030, a 34.7 percent increase over 2000 population levels (U.S. Census Bureau 2006a). The U.S. Census Bureau also designated six counties within Colorado as part of America's 100 fastest growing counties (U.S. Census Bureau 2006b).

Recreation uses may decrease or increase in correlation with increased oil and gas exploration and development. Decreases may be seen in hunting if a reduction in suitable wildlife habitat occurs. Increases may be seen in OHV use as access and number of roads is increased in the WRFO Planning Area. Increases in OHV use also open the area up to other recreational pursuits, especially hunting, scenic viewing, and camping experiences.

In accordance with BLM's Land Use Planning Handbook, BLM may establish Special Recreation Management Areas to manage important recreational resources. No SRMAs have been established within WRFO Planning Area under the 1997 White River RMP.

3.7.5 Comprehensive Trails and Travel Management

BLM's transportation program includes providing means for legal access to public land and maintenance and development of various transportation facilities. Acquisition and interests in lands and the tools used to acquire access are discussed in detail in Section 3.7.6, Lands and Realty. Rights-of-way to meet transportation needs are addressed in Section 3.7.6.2, Right-of-Way and Utility Corridors. Transportation within the Planning Area is managed for a variety of purposes by multiple agencies, including the State of Colorado, Rio Blanco, Moffat, and Garfield counties, BLM, and private individuals and corporations.

Travel management is aimed at providing adequate access to BLM-administered lands for visitor use and for administration of those lands, while regulating travel to protect public safety, prevent damage to resources, and resolve conflicts among users. Central to travel management are OHV designations. The goal of the transportation and access program of the WRFO is to actively manage travel, access, and OHV use within the area to meet public demand. For legislative purposes, 42 CFR 840 defines an OHV as "any motorized vehicle capable of or designated for, travel on or immediately over land, water, or other terrain."

It is important to explain the terminology used in this section, as the same terminology used in other resource sections may have different meanings. For example the word "open" or "closed" may have different meanings depending on the use or uses to which it is referring. "Open areas," as related to OHV use, are areas where all types of vehicle use are permitted at all times, anywhere in the area subject to the operating regulations and vehicle standards set forth in 43 CFR 8341 and 8342. "Open," as it relates to oil and gas leasing, means that all potentially productive areas, except those areas designated as closed to leasing by law, regulation or executive order, are available for OHV use. "Closed areas," as related to OHV use, are areas where OHV use is prohibited. Use of OHVs in closed areas may be allowed for certain reasons; however, such use shall be made only with the approval of the authorized officer. "Closed areas," as related to oil and gas development, are areas that are closed to OHV use. All public land areas are designated as "Open to all motor vehicle use," "Closed to all motor vehicle use," or "Limited."

The 1997 White River RMP manages OHV use areas in four ways: as limited to existing routes, limited to designated routes, closed, and closed seasonally. According to the BLM Land Use Planning Handbook, the number of categories for management of OHV areas has been decreased to three: open, closed, and limited to existing routes (BLM 2005a). The change was a result of Instruction Memorandum 2008-014 (BLM 2008e). The IM states "as required by Executive Order 11644 (as amended by Executive Order 11989) and regulation (43 CFR 8340), each RMP will designate all public lands within the Planning Area as "open," "limited," or "closed" to motorized (OHV) use (area designations)."

The OHV designation of "closed" in the 1997 White River RMP has been carried over into the RMPA. The OHV designations of "closed (August 15 to November 30)," and "existing roads, ways, trails (November 1 to August 14)" in the 1997 White River RMP, have been combined under this RMPA into one designation: "limited area." The designation of "existing roads, ways, trails October 1 to April 30" in the 1997 White River RMP represented in this RMPA as "designated roads, ways, and trails". The current designations in this RMPA match with BLM's Roads and Trails Travel Terminology (BLM 2006e).

At this time, the WRFO is mapping roads in preparation for a Travel Management Plan for the WRFO Planning Area. Policy from the 1997 White River RMP regarding trails and travel management is in effect until a Travel Management Plan for the WRFO is completed.

Interim management, pending completion of the Travel Management Plan designates:

- WSAs and Moosehead Mountain as closed
- The Cow Creek area as closed (August 15 to November 30)
- ACECs as limited to existing roads, ways, and trails
- WRFO areas not otherwise designated, as limited to existing roads, ways, and trails

A network of federal, state, and county roads provides access to the WRFO Planning Area. State Highway 13 provides access to the WRFO Planning Area from I-70 and serves as the major north/south route for the eastern portion of the Planning Area. State Highway 64 is a west-east highway and provides the route between the towns of Meeker and Rangely. Finally, SH 139 and U.S. 40 provide access to the western portion of the WRFO Planning Area. U.S. 40 is part of the National Highway System and a designated truck route. It carries a higher functional class than SH 13, SH 64, and SH 139 and supports interregional, intra-regional, and intercity travel. Collectively, the state system provides important regional access linking the I-70 corridor to northwestern Colorado and regional centers within northeastern Utah. State Highway 139, also known as the Dinosaur Diamond National Scenic Byway, is part of a major scenic byway loop that travels through the Canyon Pintado NHD. In addition to these paved highways, there are a number of BLM roads and private routes that provide access to BLM-administered lands. Many roads that were once rarely used have seen increased use in recent years due to oil and gas exploration and development.

New road construction within the WRFO Planning Area can be directly correlated with the demand for new energy development. The outcome of the 2000 Energy Policy and Conservation Act reauthorization has generated unprecedented interest in the development of oil and gas resources within the Uinta - Piceance Basin. Long-term projections for drilling activity would necessitate new road construction to access the more remote areas of the Piceance Basin. The 2007 RFD Scenario for potential oil and gas development activities in the WRFO Planning Area project the potential need for the construction of between 550 and 2,556 multiple well pads, averaging eight drilled wells per pad, over a 20-year period (between 2009 through 2028). This represents a long-term and sustained demand for new oil and gas well development, and subsequently, the roads that would be needed to support these developments. Previously constructed roads may also require upgrading in width and right-of-way as drilling operations are converted to collection and production facilities.

One area of concern for the WRFO is the proliferation of user-created OHV routes, in addition to the previously established and designated routes within the WRFO. As with most BLM lands around the country, OHV use is becoming an increasingly popular activity. As this use continues to

increase, users often create new routes in undisturbed areas. As more and more users then travel on these routes, they slowly become established travel ways, although they have not been formally designated by the WRFO. The WRFO does not currently have an accurate estimate of the amount of these user-created routes; however, they will be inventoried as part of the Travel Management planning process.

BLM roads are under the jurisdiction of the WRFO and are open to public travel at all times, subject to any limitations or restrictions outlined in the 1997 White River RMP. These roads are concentrated west of SH 13, and many connect directly to state highways and county roads.

BLM roads vary significantly in design standard, and range from 30-foot improved roads to two-track roads requiring high-clearance four-wheel-drive vehicles. Road construction has evolved over time, based upon the demand to provide access for recreation and oil and gas development into site-specific areas. There are over 300 numbered BLM roads totaling in excess of 1,680 miles, in addition to multiple private roads and other roads in the Planning Area.

Vehicle Count Data

The BLM collected vehicle traffic data for eight different sites, primarily located within the western areas of the region. The time period for data collection ran from August through November, 2006, and included Cow Creek, Sprague Gulch, Wilson Creek, and five sites along SH 139 within the Canyon Pintado NHD boundary. The highest volume of traffic recorded was at Cow Creek and Sprague Gulch and totaled 2,584 and 3,517 vehicles per week, respectively, during mid-October 2006.

The average annual daily traffic (AADT) is used as a measuring tool to determine how many autos and trucks travel in and through a region on any given day. Per the Colorado Department of Transportation (CDOT), the SH 139 2010 AADT ranged between 1,100 to 2,700 vehicles per day between Rangely and Loma; for SH 13, the 2010 AADT ranged between 3,200 to 18,000 per day between Meeker and Rifle; and for SH 64, CDOT's 2010 AADT ranged between 1,100 to 6,000 vehicles per day between Rangely and Meeker.

BLM Roads and Trails

The BLM roads provide public and administrative access to public lands and in-holdings of private land within the WRFO Planning Area. Reasonable access is made available to persons engaged in valid uses such as mining claims, mineral leases, livestock grazing, recreation, and other uses. There are three types of classified routes on BLM land: Roads, Primitive Roads, and Trails. Roads are linear routes declared a road by the owner, managed for use by low-clearance vehicles having four or more wheels, and maintained for regular and continuous use. Primitive Roads are linear routes managed for use by four-wheel drive or high clearance vehicles and are maintained per the Gold Book's [DOI 2007 pg. 23] discussion on non-constructed roads and routes. Primitive Roads do not normally meet any BLM road design standards. Trails are linear routes managed for human-powered, stock, or OHV forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high-clearance vehicles.

Transportation system management has focused on maintaining major access roads, which generally receive most of the oil and gas and recreation traffic. Corrective maintenance occurs as problems are identified and funds permit. Construction has been limited to improving or upgrading segments of a road to improve access or to alleviate maintenance or environmental problems.

Off-Highway Vehicles and Travel Management Areas

The 1997 White River RMP describes areas open to OHV use within the WRFO Planning Area. Map 3-16 displays the current roads and designated OHV areas within the WRFO Planning Area. Off-highway vehicle use is described in further detail in Section 3.7.4, Recreation.

3.7.6 Lands and Realty

The WRFO lands and realty program is aimed at managing the underlying land base that hosts and supports all resources and management programs. The key activities of the lands and realty program include: (1) land use authorizations (e.g., leases and permits, airport leases); (2) land tenure adjustments (e.g., sales, exchanges, donations, purchases); (3) withdrawals, classifications, and other segregations; and (4) ROW grants. The BLM works cooperatively to execute the WRFO lands and realty program with federal agencies, the State of Colorado, counties and cities, and other public and private landholders. Management actions are incorporated in the alternatives and described in more detail in Chapter 2.

Land Use Authorizations

Land use authorizations include various authorizations to use public surface for leases, permits, and easements under Section 302(b) of the FLPMA; Section 28 of the Mineral Leasing Act of 1920; Recreation and Public Purpose (R&PP) leases under the Recreation and Public Purposes Act (R&PP Act) of June 14, 1926 (43 USC 869 et seq.); and airport leases under the Act of May 24, 1928, as amended (49 USC Appendix, Sections 211-213). Past and current conditions associated with these components of land use authorizations are described below.

Leases, Permits, and Easements

The existing surface management pattern within the WRFO Planning Area is shown on Map 1-1, Planning Area. Surface management within all three counties is summarized in Table 3-34. Table 3-34 indicates the acreage of public lands that have been withdrawn for particular uses and the existing surface administrator. As illustrated in Table 3-34, the BLM manages the WRFO Planning Area at 1,458,100 total surface acres. Mineral estate is discussed in Section 3.7.3.

Table 3-34. Surface Management in the WRFO Planning Area

Surface Manager	Rio Blanco County (acres)	Moffat County (acres)	Garfield County (acres)	Total (acres)
BLM	1,151,100	232,700	74,300[1]	1,458,100[2]
National Park Service	0	71,500	0	71,500
FS	246,900	0	129,200	376,100
State of Colorado: CPW, Colorado State Parks, Colorado State Land Board	44,400	19,800	300	64,500
County	200	0	0	200
Private	480,500	99,800	124,900	705,200
TOTAL	**1,923,100**	**423,700**	**328,700**	**2,675,600**

SOURCE: BLM 2006b; BLM 2008d.

NOTES:

[1] The total acreage in Garfield County managed by BLM includes 4,000 acres formerly managed by the Department of Energy (Naval Oil Shale Reserve).

[2] Current total adjusted for sales and exchanges.

Sums may not equal totals due to rounding of individual cells. Acreages have been rounded to the nearest 100 acres.

Recreation and Public Purposes Act Leases and Conveyances

The R&PP Act authorizes the BLM to lease or convey public surface to state and local governments and qualified nonprofit organizations for recreation or public purpose uses. Lands are leased or conveyed for less than fair market value or at no cost for qualified uses. Examples of typical uses under the R&PP Act include historic monument sites, campgrounds, schools, parks, public works facilities, and hospitals. Lands usually are leased first until development of the area is completed and then, if appropriate, a title may be conveyed. For a description of active R&PP leases, see the White River Resource Area Draft RMP/EIS, Chapter 3 (BLM 1994).

Airport Leases

BLM administers airport leases under the Act of May 24, 1928, as amended (49 USC Appendix, Sections 211-213). The WRFO currently administers one airport lease two miles east of Rangely (BLM 1994).

Land Tenure Adjustments

Land ownership (or land tenure) adjustment refers to those actions that result in the retention of public land, disposal of public land, or the acquisition by the BLM of nonfederal lands or interests in land. The FLPMA requires that public land be retained in public ownership unless, as a result of land use planning, disposal of certain parcels is warranted. Tracts of land that are designated in BLM land use plans as potentially available for disposal are more likely to be conveyed out of federal ownership through an exchange rather than a sale. This preference toward exchange over sale is established in BLM policy. Acquisition of and interests in lands are important components of the BLM's land tenure adjustment strategy. Acquisition of and interests in land can be accomplished through several means, including exchange, purchase, donation, and condemnation, as described below. Lands and interests in lands are acquired for the following actions:

- Improve management of natural resources through consolidation of federal, state, and private lands.
- Secure key property necessary to protect endangered species, promote biological diversity, increase recreational opportunities, and preserve archeological and historical resources.
- Implement specific acquisitions authorized or directed by acts of Congress.

Approximately 11,300 acres of public land in the WRFO jurisdiction meet the suitability criteria for disposal under FLPMA, and can be disposed of by sale, exchange, or jurisdictional transfer (BLM 2007b). Management of land tenure adjustments is discussed in the White River Resource Area Draft RMP/EIS (BLM 1994).

Exchanges

Exchange is the process of trading lands or interests in lands. Public lands may be exchanged for lands or interests in lands owned by corporations, individuals, or government entities. Exchanges are the primary means by which land acquisition and disposal are carried out. Except for those exchanges that are congressionally mandated or judicially required, exchanges are voluntary and discretionary transactions with willing landowners. Exchanges serve as a viable tool for the BLM to accomplish its goals and mission. The lands to be exchanged must be of approximately equal monetary value and located within the same state. Exchanges also must be in the public interest and conform to applicable BLM land use plans.

Land exchanges are used to (1) bring lands and interests in land with high public resource values into public ownership, (2) consolidate land and mineral ownership patterns to achieve more efficient

management of resources and BLM programs, and (3) dispose of public land parcels identified for disposal through the planning process.

Purchases
The BLM has the authority, under Section 205 of FLPMA, to purchase lands or interests in lands. Similar to other acquisitions, purchase is used to acquire key natural resources or to acquire legal ownership of lands that enhance the management of existing public lands and resources. Acquiring lands and interests in lands through purchase helps consolidate management areas to strengthen resource protection. Purchases are used primarily to enhance recreational opportunities and acquire crucial wildlife habitats.

Donations and Condemnations
The BLM occasionally receives gifts or donations of lands or interests in land when an entity elects not to receive the market value for the interests being conveyed.

Disposals
Disposal areas include tracts of land that are economically difficult to manage, and/or parcels that could serve important public objectives, including, but not limited to, expansion of communities and economic development. The 1997 White River RMP identified approximately 9,100 acres of disposal land, approximately 243,700 acres of land to be retained in federal ownership, and approximately 1,282,200 acres that have not yet been designated as disposal or retention areas but would be evaluated on a case-by-case basis.

Land Sales
Section 203 of FLPMA authorizes the sale of public lands. The objective of BLM land sales is to provide a means for disposal of public lands that are found, through the land use planning process, to be suitable for disposal. Public lands must be sold at not less than fair market value and meet the sale criteria of FLPMA. Section 209 of FLPMA authorizes the conveyance of federal minerals through sale and specifies the conditions under which the mineral rights would be conveyed. The mineral rights could be sold with the land surface, sold as a separate transaction, or retained. Conveyance of mineral rights has occurred only in conjunction with the sale of land.

Withdrawals and Classifications

A withdrawal is a formal action that sets aside, withholds, or reserves federal lands for public purposes. Withdrawals accomplish one or more of the following:

- Transfer total or partial jurisdiction of federal land between federal agencies.
- Dedicate federal land to a specific purpose.
- Segregate (close) federal land from operation of some or all of the public land laws and (or) mineral laws. All the existing withdrawals segregate from operation of the public land laws, unless the surface estate is in nonfederal ownership. As used in terms of withdrawals, the public land laws refer to the body of laws governing land disposal, such as sales and exchanges. No existing or proposed withdrawal segregates from mineral material disposal, meaning that no withdrawal closes the land to permits or contracts for disposal of sand and gravel or common varieties of building materials.

Current management of withdrawals is discussed in detail in the 1997 White River RMP.

Land classification is a process required under specific laws to determine the suitability of public lands for certain types of disposal or lease, or suitability for retention and multiple use management.

Most land classifications also segregate public lands from operation of some or all of the public land laws and (or) mineral laws.

Lands proposed to be leased or conveyed under R&PP Act must first be classified as suitable for such use. The R&PP Act classifications segregate the land from operation of the public land laws except for the R&PP Act, which precludes disposal by sale, exchange or other means, but specifically allows for R&PP Act lease or conveyance. The R&PP Act classifications also segregate from operation of the mining laws, closing the area to mining of locatable minerals. The R&PP Act classifications do not segregate from mineral leasing. The R&PP leases and conveyances reserve all minerals in the land to the United Sates. Lands that are classified and leased under the R&PP Act remain segregated.

Coal withdrawals segregate lands from entry under the public lands laws and from the nonmetalliferous mining laws, pending classification of the coal potential within those lands. They remain open to mineral leasing and entry. Subsequent legislation including the 1909 and 1910 coal acts allowing nonmineral entry on coal lands, and the MLA of 1920, as amended by the Federal Coal Leasing Amendments Act, have effectively replaced the need for coal withdrawals and subsequent classification of the coal potential. There have been no coal withdrawals since the last RMP.

Other segregations result from a variety of actions, such as exchanges and land sales in which the federal mineral rights are reserved to the U.S. in the land patent.

Locatable federal minerals reserved to the U.S. in a land exchange or land sale completed under authority of FLPMA are segregated from operation of the mining laws. This segregation is the result of language in FLPMA, to the effect that such reserved federal mineral rights are not available for entry until regulations are promulgated providing for such entry. This is the same segregation affecting reserved federal minerals in R&PP Act conveyances discussed above. The implementing regulations were enacted on November 21, 2000 (65 Federal Register [FR] 70112) at 43 CFR 3809.2(a).

Management challenges identified for lands and realty in the WRFO are based, in part, on historic activities and trends, as well as on current and future needs of public resources and internal and external customers. Management challenges include managing BLM lands to adequately meet the needs of multiple uses per the FLPMA; improving the management of natural resources; obtaining important lands needed for the protection of endangered species, enhancing biological diversity, increasing recreational opportunities, and preserving archeological and historical resources; bringing into public ownership lands and interests in land with high public resource values; consolidating land and mineral ownership patterns for more streamlined management of resources and BLM programs; and disposing of lands identified for disposal.

3.7.6.1 Renewable Energy

Renewable energy is generally defined as energy derived from sources such as wind, solar, geothermal, and biomass. Wind energy refers to the kinetic energy generated from wind produced by power-generating turbines. Solar energy refers to the energy generated from the sun's rays (solar radiation) that reach the Earth. This energy can be converted into other forms of energy, such as heat and electricity. Bioenergy from biomass refers to energy from organic waste products that are either burned directly or converted to fuels that can be burned to produce energy.

There are no renewable energy sites in the WRFO Planning Area.

The BLM and the NREL issued a report in 2003 that identified public lands most suitable for increased development of renewable energy, including geothermal resources. Findings of the report indicated that the WRFO Planning Area was not among the 25 highest rated areas for potential development of geothermal power. Moreover, BLM studies indicated that the WRFO Planning Area is not considered to have high potential for geothermal power development.

The NREL completed several studies regarding potential development of wind power in western Colorado. An update of these studies provided by NREL and the Department of Energy (DOE) in April 2004 indicated that potential for wind power in the WRFO Planning Area is predominantly "poor" with a few isolated "marginal" areas.

The National Energy Policy encourages the development of renewable energy resources as part of an overall strategy to develop a diverse portfolio of domestic energy supplies for the future (National Energy Policy Development Group 2001). The U.S. wind-power-generating capacity quadrupled between 1990 and 2003 (GAO 2004). It is the BLM's general policy to encourage the development of wind-energy in acceptable areas.

Development of renewable energy projects depends on market trends and market value. The demand for renewable energy is illustrated by development projects throughout the west on public and private lands. The importance of renewable energy sources increases in the WRFO Planning Area as nonrenewable energy prices increase and as the need grows for more and cleaner energy sources. Interest in wind-energy development involving BLM-administered lands is increasing in the western U.S. Current management does not limit wind-energy development to specific areas or power classes.

3.7.6.2 Rights-of-Way and Utility Corridors

A ROW grant is an authorization to use specific pieces of public land for certain projects, such as developing roads, pipelines, transmission lines, and communication sites. The grant authorizes rights and privileges for a specific use of the land for a specific period of time. In the existing land use plan, ROW corridors were formally designated as the preferred location for existing and future ROW in the WRFO Planning Area.

An important component of the ROW program is the intrastate and interstate transportation of commodities ultimately delivered as utility services (e.g., natural gas, electricity) to residential and commercial customers. Equally important on the local level is the growing demand for legal access to private homes and ranches using ROW grants.

The BLM and other agencies (Office of Electricity Delivery and Energy Reliability, DOE, and the FS) prepared the West-wide Energy Corridor Programmatic EIS. The EIS designated corridors on federal land in the 11 Western States (including Colorado) for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities. The BLM and other agencies amended their respective land use plans by designating a series of energy corridors effective upon signing of the Approved Resource Management Plan Amendments/Record of Decision for Designation of Energy Corridors on Bureau of Land Management-Administered Lands in the 11 Western States in 2009 (see Map 3-17).

The WRFO manages ROWs through a system of designated corridors and designated ROW exclusion and avoidance areas. The WRFO has encouraged the placement of new facilities within established corridors. Deviations from designated corridors have been permitted based on the type and need of the proposed facility, and lack of conflicts with other resource values and uses.

Overlapping or adjacent ROWs are issued whenever possible. Generally, the use of designated ROW corridors for ROW grants is actively encouraged by the BLM; however, the presence of a designated ROW corridor or a system of ROW corridors does not preclude the granting of a ROW on public land outside the designated corridor, if appropriate.

The WRFO receives requests for approximately 219 land use transactions each year; a majority of these are ROWs. Generally, most of these transactions are requests for ROWs for roads, utilities, pipelines, and telecommunication facilities. Such transactions include a fiber optic line and various interstate pipelines ranging from 24 to 42 inches in diameter. Eight separate companies hold interstate pipeline ownership and associated ROW grants on BLM-managed lands within the WRFO: Colorado Interstate Gas Company, TransColorado Gas Transmission Company, WIC/El Paso, Questar Pipeline Company, Williams Northwest Pipeline, MAPCO/Enterprise, Rocky Mountain Pipeline Company, and Entrega/Rockies Express Pipeline, LLC. Several small pipelines and gathering systems are located throughout the WRFO Planning Area.

The WRFO issues ROW for communication sites on public land. Rights-of-way for communication sites are limited to currently occupied sites although exceptions would be granted for "non-commercial, private mobile, or microwave facilities by pipeline/power companies or land management entities, in support of their primary business, where no existing site can be shown to meet the applicant's needs" (BLM 1997a). Additional authorizations would not be granted for the communication site located on Moosehead Mountain.

Future needs for developed land uses include public lands identified for disposal, designated corridors, or existing utility alignments and/or ROWs, and existing communication sites. The need for power transmission, telecommunication, infrastructure improvements, and pipeline capacity is anticipated. The demand for ROWs and corridors is influenced by specific actions within the WRFO Planning Area (such as oil and gas leasing) and by economic forces and other external pressures and conditions independent of resource management decisions in the WRFO Planning Area. For example, the demand for expanded infrastructure capabilities throughout the WRFO Planning Area can be dictated largely by state or national needs and requirements. Technological advancements also have brought new demands for public land largely related to wind energy and telecommunications (e.g., cellular and fiber optic advancements).

3.8 Special Designations and Other Management Areas

Areas of Critical Environmental Concern, National Back Country Byways, National Historic Trails and Other Historic Trails, Wild and Scenic Rivers (WSRs), and WSAs are discussed within this section. Areas managed under Special Designations are regulatory or congressionally mandated and are designed to protect or preserve certain qualities or uses. Management actions for special designations are incorporated in the alternatives and described in more detail in Chapter 2.

3.8.1 Areas of Critical Environmental Concern and Other Management Areas

An ACEC is defined in FLPMA, Public Law 94-579, Section 103(a) as an area within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards. The BLM prepared regulations for implementing the ACEC provisions of FLPMA. These regulations are found at 43 CFR 1610.7-2(b).

There are currently 17 ACECs within BLM-administered lands of the WRFO, totaling 100,600 acres (Map 3-18). The size of each area and the values it is designed to protect are listed in Table 3-35. The values for which these 17 ACECs were designated are still present and require continued management attention.

Table 3-35. Areas of Critical Environmental Concern

ACEC	Area (acres)	Values
Blacks Gulch	800	Paleontology
Coal Draw	1,800	Paleontology
Coal Oil Rim	3,200	Small aspen clones and other biologically diverse plant communities; riparian habitats
Deer Gulch	1,800	Sensitive plants and remnant vegetation associations
Duck Creek	3,400	T/E[(3)] plants and cultural resources
Dudley Bluffs	1,600	T/E plants; sensitive plants and remnant vegetation associations
East Douglas Creek	47,600	Biologically diverse plant communities; riparian habitats; and Colorado River cutthroat trout fisheries
Lower Greasewood Creek	200	Sensitive plants and remnant vegetation associations
Moosehead Mountain	8,900	Important biologically diverse plant communities; riparian habitats and cultural resources
Oil Spring Mountain	18,300	Spruce fir and important biologically diverse plant communities
Raven Ridge[(1)]	5,000	T/E plants; paleontology; sensitive plants; remnant vegetation associations; and fragile soils
Ryan Gulch	1,400	T/E plants
South Cathedral Bluffs[(2)]	1,300	Sensitive plants and remnant vegetation associations
Trapper/Northwater Creek	1,100	Sensitive plants and Colorado River cutthroat trout fisheries
Yanks Gulch/Upper Greasewood Creek	2,700	T/E plants; sensitive plants and remnant vegetation associations
White River Riparian	950	Important biologically diverse communities; bald eagle nest and roost habitat; designated critical habitat for endangered Colorado pikeminnow below Rio Blanco Lake State Wildlife Area
Total	100,050	

SOURCE: BLM, 1997a.

NOTES:

[(1)] Includes Raven Ridge Addition

[(2)] Includes South Cathedral Bluffs Addition

[(3)] T/E = threatened/endangered

Restrictions that arise from an ACEC designation are determined at the time the designation is made, and are designed to protect the values or serve the purposes for which the designation was made. In addition, ACECs are protected by the provisions of 43 CFR 3809.1-4(b)(3), which requires an approved plan of operations for activities (except casual use) under the mining laws.

Oil and gas leasing has taken place for some lands within the existing ACECs. Although the values for which these ACECs were designated are still present and managed, some of the ACECs have experienced ground disturbance related to oil and gas activities. This is in accordance with the management outlined for ACECs in the 1997 White River RMP, which allows for multiple uses of ACECs while maintaining the special values for which the ACEC was designated. The 1997 White River RMP included lease stipulations of NSO or CSU for ACECs. Leases in ACECs that were

effective before the 1997 White River RMP do not necessarily carry an NSO stipulation or a CSU stipulation, unless required for some other resource protection purpose. Table 3-36, lists the total acreage within each ACEC that is leased for oil and gas, and breaks out that acreage into acres leased before or after the 1997 White River RMP. The number of existing producing wells is also listed to provide a measure of the existing oil and gas activity within the ACECs. Trapper/Northwater Creek was not a designated ACEC in the 1997 ROD, and does not have prior corresponding data.

Table 3-36. Leased Acreage within ACECs

ACEC	Total Area (acres)	Total Area Leased (acres)	Leased Acres (Before 1997 ROD)	Leased Acres (After 1997 ROD)	No. of Producing Oil or Gas Wells[1]
Blacks Gulch	800	800	720	83	0
Coal Draw	1,800	1,800	1,800	0	8
Coal Oil Rim	3,200	100	100	0	0
Deer Gulch	1,800	1,800	0	1,800	0
Duck Creek	3,400	3,400	840	2,600	0
Dudley Bluffs	1,600	1,600	770	840	0
East Douglas Creek	47,600	27,500	23,500	4,000	42
Lower Greasewood Creek	210	210	0	210	0
Moosehead Mountain	8,900	6,300	0	6,300	0
Oil Spring Mountain	18,300	9,100	9,700	0	1
Raven Ridge[2]	5,000	2,000	160	1,100	0
Ryan Gulch	1,400	1,400	580	860	2
South Cathedral Bluffs[3]	1,800	760	530	230	0
Trapper/Northwater Creek[4]	1,100	1,100	NA[5]	1,100	0
Upper Greasewood Creek	2,400	2,300	0	230	0
White River Riparian	940	460	240	410	1
Yanks Gulch	250	210	0	210	0
Total	100,500	68,300	54,100	14,300	54

SOURCE: BLM GIS Data, 2009.

NOTES:

[1] Includes only producing wells as described in the COGCC database. Areas may also have dry, plugged, abandoned, or shut-in wells.

[2] Includes Raven Ridge Additions

[3] Includes South Cathedral Bluffs Addition

[4] Trapper/Northwater Creek was not a designated ACEC in the 1997 ROD, and does not have prior corresponding data.

[5] NA = not applicable

3.8.2 National Back Country and Scenic Byways

The BLM began a byway program in 1989 with a focus on enhancing recreational opportunities. A National Scenic Byway System was created two years later under Section 1047 of the Intermodal Surface Transportation Efficiency Act of 1991. This act recognized the BLM National Back Country and Scenic Byways as a component of the National Scenic Byway System (Section 1032, eligible projects). The objectives of this program are to do the following:

- Enhance opportunities for the American public to see and enjoy the unique scenic and historical opportunities on public lands.
- Foster partnerships at local, state, and national levels.
- Contribute to local economies.
- Enhance the visitor's recreational experience and communicate the multiuse management message through effective interpretative programs.
- Manage visitor use along the byway to minimize impacts to the environment and to provide protection for the visitor.
- Contribute to the National Scenic Byway Program in a way that is uniquely suited to national public lands managed by the BLM.

The WRFO Planning Area includes two scenic byways: Dinosaur Diamond and the Flat Tops Trail. The Dinosaur Diamond National Scenic Byway is a 512-mile scenic loop within eastern Utah and western Colorado. The Dinosaur Diamond National Scenic Byway traverses the western portion of the WRFO Planning Area along SH 139 and SH 64, passing through the towns of Rangely and Dinosaur (Dinosaur Diamond Partnership, Inc. 2000). The byway is used primarily for viewing paleontological and archaeological resources, and over the past decade, travel demand has increased along SH 139 between I-70 and Rangely. Statistically, annual daily traffic in 1994 averaged 510 vehicles per day and in 2007 traffic volumes have increased to approximately 1,000 vehicles per day. The increase is due, in part, to the fact that SH 139 has historically served the Rangely Weber Sand Unit, an oil producing area discovered in 1933 that provides about one third of Colorado's total oil production.

The Flat Tops Trail Scenic Byway bisects the original White River Plateau Timberland Reserve, set aside in the late 19th century as the second unit of what eventually became the White River National Forest system. The Byway is 82 miles long, and runs between Meeker and Yampa, mostly on FS-managed lands. This Scenic Byway showcases the White River National Forest's long history of multiple-use land management. The Flat Tops Trail Scenic Byway contains pristine scenery and excellent wildlife viewing, yet this remains very much a "working" byway, dotted with active mines, ranches, and timber-producing woodlands. Visitors to this byway can explore forests, meadows, rivers, and a museum (U.S. Department of Transportation 2007).

3.8.3 National Historic Trails and Other Historic Trails

The WRFO does not manage any National Historic Trails or Other Historic Trails.

3.8.4 Wild and Scenic Rivers

Currently, there are no Wild and Scenic Rivers (WSRs) or congressionally designated study rivers within the WRFO Planning Area. Thirteen river and stream corridors within the WRFO Planning Area were inventoried for WSR characteristics, and eight were found eligible (BLM 1994); however, none of the eight river segments were recommended as suitable for WSR designation (BLM 1997a). Accordingly, no additional WSR analysis was conducted as part of this land use planning effort. See the White River Resource Area Draft RMP/EIS (BLM 1994) for additional discussion of WSR designations within the WRFO Planning Area.

3.8.5 Wilderness Study Areas

Wilderness Study Areas are areas that contain wilderness characteristics such as naturalness, solitude, and opportunities for primitive and/or unconfined recreation and are managed to preserve those values until Congress either designates them as wilderness or releases them for other uses. In 1964, Congress passed the Wilderness Act, thereby establishing a national system of lands for the purpose of preserving a representative sample of ecosystems in a natural condition for the benefit of future generations. Until 1976, most land considered for, and designated as, wilderness was managed by the NPS and FS. With the passage of FLPMA in 1976, Congress directed the BLM to inventory, study, and recommend which public lands under its administration should be designated wilderness.

In 1980, BLM completed the wilderness inventory of BLM-administered lands within the WRFO finding six areas that possess wilderness character (see Table 3-37). A discussion of the current resource values and uses found in each area, established in 1980 under the authority of Section 603 (c) of FLPMA, can be found in the Colorado BLM Statewide Wilderness Study Report (BLM 1991). These areas were included in the Craig District Final Wilderness EIS published November 5, 1990, and in the Craig District Study Areas Wilderness Study Report published October 1991. Three have been recommended to Congress for designation as wilderness, and three have been recommended for uses other than wilderness. The attributes of each WSA are described in the two documents listed above.

Table 3-37. Wilderness Study Areas in the White River Field Office

Proposal Name	Area (in acres)	Recommended for Wilderness
Bull Canyon	13,900	Yes
Willow Creek	14,100	Yes
Skull Creek	14,000	Yes
Black Mountain	10,200	No
Windy Gulch	12,400	No
Oil Spring Mountain	18,200	No
TOTAL	82,800	42,000

SOURCE: BLM 1991.

Only Congress can designate the WSAs established under Section 603 of FLPMA as wilderness or release them for other uses. The status of the existing WSAs would not change as a result of this RMPA/EIS.

During the interim period between the inventory that identifies suitable and eligible areas appropriate for wilderness designation and the actual congressional designation of a wilderness (which can be many years), designated WSAs require special management practices to preserve the wilderness characteristics that make an area appropriate for designation.

These WSAs are being managed to preserve their wilderness values according to the Interim Management Policy (IMP), and would continue to be managed in that manner until Congress either designates them as wilderness or releases them for other uses. Should any of these WSAs be released from wilderness consideration by Congress and subsequently released from management under the IMP, subsequent planning documents would prescribe how these lands would be managed.

The only congressionally designated wilderness area within the WRFO is a portion of the Flat Tops Wilderness, located within the White River National Forest is managed by the United States Forest Service (USFS), Blanco Ranger District.

Examples of some of the activities that are allowed in WSAs include hunting, fishing, camping, hiking and horseback riding, and livestock grazing. Activities that would impair wilderness suitability are prohibited in WSAs.

Current management of the six WSAs listed in Table 3-37 will continue as described in the 1997 White River RMP (BLM 1997a). According to WSA monitoring reports since 1999, no major impairment has occurred to the WSAs. Minimal vehicle traffic and fire suppression activities were noted. Based on this information, current management is successfully protecting the wilderness characteristics found within these three WSAs as well as non-recommended WSAs.

3.9 Non WSA Lands with Wilderness Characteristics

3.9.1 Resource Overview

In accordance with the FLPMA, through the land use planning process, the BLM is required to consider all available information in order to determine the mix of resource use and protection that best serves the multiple-use and sustained-yield mandate. Under the FLPMA, the BLM has numerous authorities requiring the agency to maintain inventories of all public lands and their resources, including wilderness characteristics, and to consider such information during the land use planning process. Consistent with Section 201 of the FLPMA, which requires the Secretary of the Interior to "prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values," and the BLM Land Use Planning Handbook, the WRFO has identified and begun an assessment of BLM-managed lands with wilderness characteristics outside of existing WSAs. The BLM Manual 6310 - Conducting Wilderness Characteristics Inventory on BLM Lands, provides the guidance from which the WRFO performed the wilderness characteristic inventory process.

The wilderness characteristics inventory and assessment process is designed to answer the following question:

- Do any portions of the WRFO meet the overall criteria for wilderness character?

The assessment reflects current conditions and is used to update wilderness inventories as well as identify other areas within WRFO that may potentially contain wilderness characteristics. The process entails the identification of Wilderness Inventory Units, an inventory of roads and wilderness character, and a determination of whether or not the area meets the overall criteria for wilderness character (naturalness, outstanding opportunities for solitude, and primitive and unconfined types of recreation). Units found to possess such character are being evaluated during the land use planning process in order to address future management. The following factors are documented:

Size:
For an area to qualify as lands with wilderness characteristics, it must possess sufficient size according to one of the conditions listed below:

- Roadless areas over 5,000 acres of contiguous BLM lands. Non-federal lands are not considered.

- Roadless areas under 5,000 acres of contiguous BLM lands where any of the following applies:
    - Contiguous with lands formally determined to have wilderness or potential wilderness values or with any Federal lands managed for the protection of wilderness characteristics, including designated wilderness, the BLM WSAs, FWS areas proposed for wilderness designation, FS WSAs or areas recommended for designation as wilderness, and NPS areas recommended or proposed for designation. This does not include NPS areas merely considered eligible for wilderness study or FS Roadless Areas unless also designated or recommended for designation through a forest plan revision.
    - Of sufficient size to make practicable their preservation and use in an unimpaired condition.
    - Any roadless island of the public lands.

Naturalness:
Lands and resources exhibit a high degree of naturalness when affected primarily by the forces of nature and where the imprint of human activity is substantially unnoticeable. An area's naturalness may be influenced by the presence or absence of roads and trails, fences or other developments; the nature and extent of landscape modifications; the presence of native vegetation communities; and the connectivity of habitats. Wildlife populations and habitat are recognized as important aspects of naturalness and would be actively managed. Assessing an area for naturalness includes examining the area for attributes such as the presence or absence of roads and trails, fences, and other infrastructure; the nature and extent of landscape modifications; the presence of native vegetation communities; and the connectivity of habitats.

Outstanding Opportunities for Solitude and Primitive and Unconfined Types of Recreation:
Visitors may have outstanding opportunities for solitude, or primitive and unconfined types of recreation, when the sights, sounds, and evidence of other people are rare or infrequent, where visitors can be isolated, alone or secluded from others, where the use of an area is through non-motorized, non-mechanical means, and where no or minimal recreation facilities are encountered.

Supplemental Values:
These include ecological, geological, or other features of scientific, educational, scenic, or historical value.

Activities that could affect lands with wilderness characteristics are those that would impair naturalness and outstanding opportunities for solitude and primitive and unconfined types of recreation. Examples include construction of new roads or structures and an increase in recreational use that affects solitude and primitive recreation opportunities. Actions that would have an effect on wildlife habitat and native vegetation communities would also adversely affect lands with wilderness characteristics.

3.9.2 Methods of Analysis

During the WRFO RMPA process, the BLM completed an initial review of its lands within the field office to determine which, if any, areas possess wilderness characteristics. This review included only BLM lands and did not include existing WSAs. Lands exclusively within existing WSAs were not analyzed; however, lands with potential wilderness characteristics outside or adjacent to WSAs were assessed. Existing designated WSAs would continue to be managed to protect those

wilderness characteristics under the BLM's interim management policy until Congress designates them as wilderness or releases them for other uses (see Section 3.8.5, Wilderness Study Areas). Areas evaluated for wilderness character consisted of roadless areas greater than 5,000 acres or roadless areas less than 5,000 acres adjacent to a WSA. These areas were evaluated for the presence of naturalness and outstanding opportunities for solitude and primitive and unconfined types of recreation.

In December of 2010, the WRFO began the process of identifying and inventorying potential lands with wilderness characteristics within its administrative boundaries. The first step in this process was to conduct a GIS analysis to identify 5,000 acre roadless parcels. The six WSAs in the Planning Area were removed from this analysis as they are managed under the National Landscape Conservation System (NLCS). The identification of the 5,000 acre parcels was accomplished by running a query using all roads within WRFO as polygon boundaries. All the polygons created by road boundaries were then queried to identify those that were a minimum of 5,000 acres or greater. Those polygons greater than 5,000 acres in size were identified for refined analysis.

The refined analysis was accomplished by visually comparing the remaining individual polygons with aerial imagery, as well as oil and gas, pipeline, powerline, transportation and roads layers to determine if they meet other minimum standards for lands with wilderness characteristics. They were also examined as to whether or not they could be modified (reduced in size) and still meet the minimum standard. This process was conducted by WRFO staff with extensive on-the-ground local knowledge of the resource area to aid in verifying the suitability of individual polygons to be considered as lands with wilderness characteristics. This process resulted in the identification of 30 individual polygons, totaling 251,500 acres, potentially containing lands with wilderness characteristics that were proposed for an intensive, on-the-ground field inventory. These potential wilderness character units are shown on Map 3-19.

3.9.3 Current Conditions

Inventoried Units

As part of a court settlement related to the 2008 Oil Shale and Tar Sands Programmatic Environmental Impact Statement (PEIS) ROD, the BLM agreed to analyze the environmental effects of an alternative in a NEPA analysis that would exclude from oil shale or tar sands leasing, all areas the BLM has identified, or may identify as a result of inventories conducted, as lands containing wilderness characteristics. As such, in June of 2011, the WRFO began an inventory of potential lands with wilderness characteristics, beginning with those polygons within the area proposed for oil shale lease allocation. Following Washington Office implementation guidelines, the WRFO identified five polygons (Map 3-19) of sufficient size with minimal roads present within the proposed oil shale lease area (Table 3-38). Available budget and time allowed for one additional polygon (Polygon 29 – Big Ridge), to be inventoried in 2011. This polygon was selected because it was proposed as wilderness in 1979 and rejected. It was then again proposed by the public as a Citizen's Wilderness Proposal (CWP) in 2002.

Table 3-38. Non WSA Land with Wilderness Characteristics - Polygons Inventoried

Polygon #	Acres (oil shale)	Acres (total)	Routes (miles)	Inventory Walked (miles)
5	2,300	5,200	5.0	13.8
8	2,000	6,200	6.6	19.5
9	7,800	8,400	6.0	18.2
11	8,900	10,300	6.9	27.5
12	1,300	11,900	5.8	28.9
29	NA	24,900	23.1	30.9

SOURCE: BLM GIS 2011.
NOTE:
NA = not applicable

The following assumptions were made in conducting the inventory:

- A representative sample of the lands would be analyzed (approximately 50 percent of each polygon) utilizing GPS, photographic, and written documentation;
- Inventory of roads and on-sight observations would be conducted for each polygon; and
- If a portion of a polygon is located within the Oil Shale Lease Area, the entire polygon would be inventoried.

Interdisciplinary teams were assembled and appointed the task of conducting the inventories. The ID teams were composed of a mix of resource specialists representing a range of subject area expertise, including outdoor recreation, archeology, botany, ecology, petroleum engineering, GIS, and general natural resources.

Polygon 5 - Wagonroad Gulch/Galloway Gulch Area: 5,200 acres

The polygon is bordered by private lands on the north and south, by BLM Road 1020 to the west, and RBC 144 to the east. The topography is bisected by long, flat mesa-like top ridges adjacent to deep drainages. The vegetation ranges from basin big sagebrush and grasses in the drainage bottoms with pinyon/juniper side slopes transitioning to mountain mahogany, serviceberry, mountain big sagebrush, native grasses, and wildflowers on the ridge tops. Motorized access is limited into the area by terrain and private lands. There are five routes identified within the original boundary. Four routes into the area are two-track routes coming from private lands with no evidence of construction or maintenance, and minimal evidence of utilization. The upper half of one route was currently being used by the CPW to conduct sage-grouse studies. One route entering into the polygon from the east is a natural gas pipeline, where the lower half is completely overgrown with sagebrush and only a cow trail is being utilized, but the upper half is still being used, most likely by hunters for upland big game hunting. This route was removed from the polygon creating a cherry stem. The remaining routes are difficult to see until the observer is within 30 feet of the route.

There is a barbed-wire fence, some stock tanks, and stock ponds within the polygon. The overall human modifications to the landscape are substantially unnoticeable, giving the area an apparent naturalness to an average visitor. With the limited access, terrain, views, apparent naturalness, and lack of outside intrusions, the area presented an outstanding opportunity for solitude. The same factors present for solitude also provide for outstanding primitive recreational opportunities in the

forms of hunting, hiking, horseback riding, wildlife viewing, and photography, especially of wildflowers. As such, this meets the overall criteria for possessing wilderness characteristics.

Polygon 8 – Ernie Howard Gulch Area: 6,200 Acres

This polygon is bordered by CPW lands on the north and south, to the east by BLM Road 1154, and to the west by Piceance Creek and private lands. The topography can be characterized by one large main ridge that has multiple spur ridges separated by deep narrow drainages that flow to a wide valley bottom. The vegetation is pinyon/juniper woodlands with intermixed mountain sagebrush, mountain mahogany, and grasses on the ridges to basin big sagebrush and grasses in the drainage bottoms. There is evidence of large wildland fires where there is a presence of standing dead pinyon/juniper trees surrounded by grasses in the most recent scars to mixed brush in the older burn scars. Motorized access is available to the public from the north but terrain and vegetation restrict travel beyond existing routes in the area. All access is restricted by CPW from the south into the polygon to authorized users only. Ten routes have been identified within the polygon. One route leads to a USGS water monitoring well, four routes go to range water improvement sites, and the remaining five routes are user created routes, primarily for access. Human improvements are limited primarily to areas near the perimeter of the polygon. Routes within the interior of the polygon are rarely used and are difficult to see, with the best evidence of use being primarily during upland big game hunting season.

Evidence of human improvements is largely unnoticeable; the mosaic appearance of the vegetation with the burn scars and the topography in general would, to the average visitor, give the area an apparent naturalness. The layout of the topography, the height of the vegetation, and the lack of outside intrusions (from the sight of development or the sounds of civilization), provide for an outstanding opportunity for solitude. These same factors contribute to an outstanding opportunity for some primitive recreational opportunities like hunting, hiking, horseback riding, and photography. Therefore this area was determined to meet the criteria for possessing wilderness characteristics.

Polygon 9 – Barcus Creek Area: 8,400 Acres

This polygon is bordered by RBC 88 to the east, BLM Road 1033 to the north, BLM Road 1036 to the west and RBC 122 to the south. The topography can be characterized as two long gradually sloping ridges with wide drainages on either side. The vegetation along the ridge tops are mountain mahogany, mountain big sagebrush, native grasses at the higher elevations and pinyon/juniper woodlands mixed with the mountain mahogany and grasses at lower elevations. The drainage bottoms are native grasses and basin big sagebrush. The eastern half of the polygon has mosaic patches of pinyon/juniper vegetative communities as a result of the large fire history in the area. The fire scars have standing and down dead pinyon/juniper with primarily grass as the dominant vegetation. There are 11 routes identified within the polygon. Only two of the routes showed regular and continuous use, primarily as access for hunting. Due to the large fires that have occurred in the polygon and the level of re-vegetation efforts, the native grasses have overgrown the routes, making them largely unseen from the perimeter. The public, therefore, has not been utilizing these routes.

The routes and other human improvements are difficult to see until within 30 feet. This gives an apparent naturalness to the average visitor within the area. There are two fence lines present just inside the southern boundary, and the other fence bisects the northern most ridge. There are stock ponds present in each drainage. There is an oil and gas well pad with a dry hole marker that is minimally reclaimed but there is grass, brush, and a few juniper trees growing on the site. The topography, vegetation, and size of the polygon allow for outstanding opportunities for solitude.

The same factors also provide for some outstanding primitive recreational opportunities like hunting, hiking, horseback riding, snowshoeing, cross country skiing, and wildlife viewing. This area was found to meet the criteria for possessing wilderness characteristics.

Polygon 11 – Yellow/Barcus Creek Area: 10,300 Acres

The boundaries of this polygon are RBC 88 to the west and north, RBC 122 and a natural gas lease to the south, and BLM Road 1257 to the East. The topography can be characterized as a ridge parallel to Barcus Creek with spur ridges breaking off towards the Yellow Creek and Barcus Creek drainages with deep drainages in between. The vegetation is pinyon/juniper woodland dominating the ridges with basin big sagebrush communities dominating the drainage bottoms. There are eight routes identified within the polygon. There are three stock ponds within the polygon, one old well pad and the presence of old seismic activity that the public has been using as routes for access into the area. The steep topography and pinyon/juniper vegetation within this area minimizes the ability for the creation of routes beyond those that already exist. The minimal use of these routes is primarily concentrated during upland big game hunting season.

The inability to see the routes coupled with the type and height of the vegetation and the basin/ridge type of topography allow for apparent naturalness to the average visitor within the area. The topography, vegetation, and size of the polygon allow for outstanding opportunities for solitude. The same factors also provide for some outstanding primitive recreational opportunities like hunting, hiking, horseback riding, snowshoeing, and wildlife viewing. This area was found to meet the criteria for possessing wilderness characteristics.

Polygon 12 – Greasewood Creek Area: 11,900 Acres

The boundaries for this polygon are RBC 89 and BLM Road 1137 to the north, RBC 88 and BLM Road 1033 to the east and south, and BLM Road 1036 to the west. The topography is one large ridge with deep drainages on either side moving from west to east which then fans out into smaller spur ridges and drainages that flow to meet with the confluences of Yellow Creek and Barcus Creek to the northeast and Yellow Creek and Greasewood Creek to the north. The vegetation on the ridge tops is mountain mahogany, serviceberry, mountain big sagebrush, native grasses, and wildflowers at the higher elevations and pinyon/juniper woodlands in the lower elevations. The drainage bottoms are dominated by basin big sagebrush plant communities. Polygon 12 also has a history of large fires with the scars bisecting the area creating a vegetative mosaic. The fire scars are dominated by grasses. Due to the topography and lack of development, there are few routes within the polygon. The presence of past seismic activities created routes, but re-vegetation as a result of the fires has allowed the grasses to overgrow the majority of the routes. The only real presence of routes that are regularly used is where the seismic routes traverse the pinyon/juniper woodlands in the northeast corner of the polygon. The condition of these routes indicates that they are primarily use during the upland big game hunting season. The routes are either in the southwest portion of the polygon or in the northeast portion of the polygon. The topography and vegetation restrict the ability for additional user routes to be created. This gives an apparent naturalness to the average visitor with in the area. The topography, vegetation, and size of the polygon allow for outstanding opportunities for solitude. The same factors also provide for some outstanding primitive recreational opportunities like hunting, hiking, horseback riding, snowshoeing, cross country skiing, and wildlife viewing. As such, the area was found to possess wilderness characteristics.

Polygon 29 – Big Ridge: 24,600 acres

This polygon is bordered by private lands on the southeastern edge, by BLM Road 1040 to the east, RBC 138 to the north, SH 139 to the west and BLM Road 1121A to the south. The topography is bisected by a series of long, flat mesa-like top ridges adjacent to deep drainages running east-west. The vegetation ranges from basin big sagebrush and grasses in the drainage bottoms with pinyon/juniper side slopes transitioning to mountain mahogany, serviceberry, mountain big sagebrush, native grasses, and wildflowers on the ridge tops. Motorized access is generally limited into the area by steep terrain. There are 14 routes that were identified within the original polygon boundary. Five of the routes were observed in the central portion of the unit in the vicinity of State Bridge Draw and East Four Mile Draw. Two routes are reclaimed oil and gas access roads. Each has been re-vegetated and is almost completely overgrown, showing no evidence of recent use. One route is an abandoned road that shows little evidence of regular use, possibly only sporadic use by hunters. A few old, worn ATV tracks were observed as well as some old, spent rifle shells. One route was an old two-track that led to an oil and gas pumphouse. It did not appear to be regularly used and was not regularly maintained. One route showed minimal evidence of ATV use, likely for hunting. This route was barely visible and like only used one time. Eight of the routes observed are located in the northern portion of the unit, generally off RBC 138 and BLM Road 1118A. BLM Road 1118A generally creates a loop however is not completely passable by motorized vehicle due to sustained severe erosion. This route shows evidence of regular and continuous use from the presence of well-worn ATV tracks. One route in this area appears to have been constructed as a fire break. Although it is beginning to overgrow, it does show evidence of sporadic use for access. One route is a road leading to an abandoned well pad. The well pad has been reclaimed however the road has not been and it shows evidence of use for hunting and camping. Five other routes are two-tracks showing evidence of sporadic use by ATVs and for hunting. These routes appear to be somewhat regularly used, likely during hunting season. Due to the apparent regular use, leading to a diminishment in naturalness and opportunities for solitude and primitive types of recreation, it is recommended that these eight routes be cherry stemmed and removed from Polygon 29. The last route observed is located in the southeastern portion of the unit. This route is a worn down two-track, likely used by livestock. There is no evidence of regular or continuous use, although this route can be seen from a distance when observed from higher ground. This is a large unit and the overall human modifications to the landscape are substantially unnoticeable, giving the area a highly apparent naturalness to the average visitor. With the limited access, generally steep terrain, dramatic views of the Cathedral Bluffs, apparent naturalness, and lack of outside intrusions, the area presented an outstanding opportunity for solitude. The same factors present for solitude also provide for outstanding primitive recreational opportunities in the forms of hunting, hiking, horseback riding, wildlife viewing, and photography, especially of wildflowers. As such, the area was found to possess the criteria for wilderness characteristics.

Units Needing Additional Inventory

Of the 30 units identified as potentially containing wilderness characteristics, a total of six have been inventoried, five of which lie within the Oil Shale Lease Area. Until the time when a complete inventory can be conducted on the remaining units and a final determination made as to the presence of wilderness character within each, it is assumed that each unit possess wilderness characteristics for the purposes of this planning document. Table 3-39 lists each remaining unit and its size in acres.

Table 3-39. Units Potentially Containing Lands with Wilderness Characteristics

Polygon #	Size (acres)	Polygon #	Size (acres)
1	12,200	**18**	5,400
2	5,200	**19**	6,000
3	5,400	**20**	9,000
4	6,800	**21**	9,100
6	12,600	**22**	13,100
7	8,400	**23**	5,000
10	7,600	**24**	4,900
13	10,400	**25**	9,600
14	5,700	**26**	6,500
15	6,600	**27**	9,100
16	7,900	**28**	6,800
17	7,200	**30**	4,100

SOURCE: BLM GIS 2011.

3.10 Socioeconomic Resources

The Socioeconomic Resources section describes existing conditions for Social Conditions, Economic Conditions, Health and Safety, and Environmental Justice. This section is a summary of the stand-alone technical report authored by BBC Research & Consulting (BBC) and Lloyd Levy Consulting, LLC, which is included in Appendix G.

Methods

Information to characterize baseline socioeconomic conditions in the study area was assembled from local, state, and federal data sources, as well as previous reports and publications. Interviews were conducted with local sources within the Primary Socioeconomic Study Area (PSSA) and Secondary Socioeconomic Study Areas (SSSA) (defined later in this section), including local government officials, ranchers, recreational interests, and various other sources. A complete list of these sources is provided in Appendix G.

Published data were used to describe current conditions and historic trends in measures such as total population, ethnic/minority population, housing, total employment, employment by sector, earnings by sector, labor force, unemployment rates, household income, public services and fiscal conditions, and other general economic and demographic metrics. Information from a number of previous reports also contributed substantially to the description and evaluation of existing socioeconomic conditions.

Definition of the Primary and Secondary Socioeconomic Study Areas

For purposes of this analysis, the study team has categorized northwestern Colorado into a PSSA and a SSSA. While the BLM WRFO includes lands in Moffat and Garfield counties, the vast majority of the population within the WRFO resides in Rio Blanco County. Consequently, Rio Blanco County constitutes the PSSA. The SSSA is a broader region that includes both sparsely populated lands in Garfield and Moffat counties that are within the WRFO, and other areas of northwestern Colorado that have indirect social and economic ties with WRFO activities. Though

these areas are termed the "Secondary" Socioeconomic Study Area, they would likely provide business support services as well as additional housing or community services associated with changes in WRFO management practices and may experience substantial effects from WRFO management alternatives.

The Primary Socioeconomic Study Area

The BLM WRFO encompasses virtually all of Rio Blanco County, in addition to small portions of northern Garfield and southern Moffat counties (see Map 1-1, WRFO Planning Area). It is likely that unincorporated Rio Blanco County and the nearby towns of Meeker and Rangely would be the communities most immediately and directly affected by changes in resource management policies and any new workforce-related population or related demand for housing and public services (though the City of Rifle, in the SSSA, is also likely to house a substantial portion of the workforce associated with WRFO management alternatives). Based on this assessment, the PSSA is defined as Rio Blanco County, which includes the towns of Meeker and Rangely.

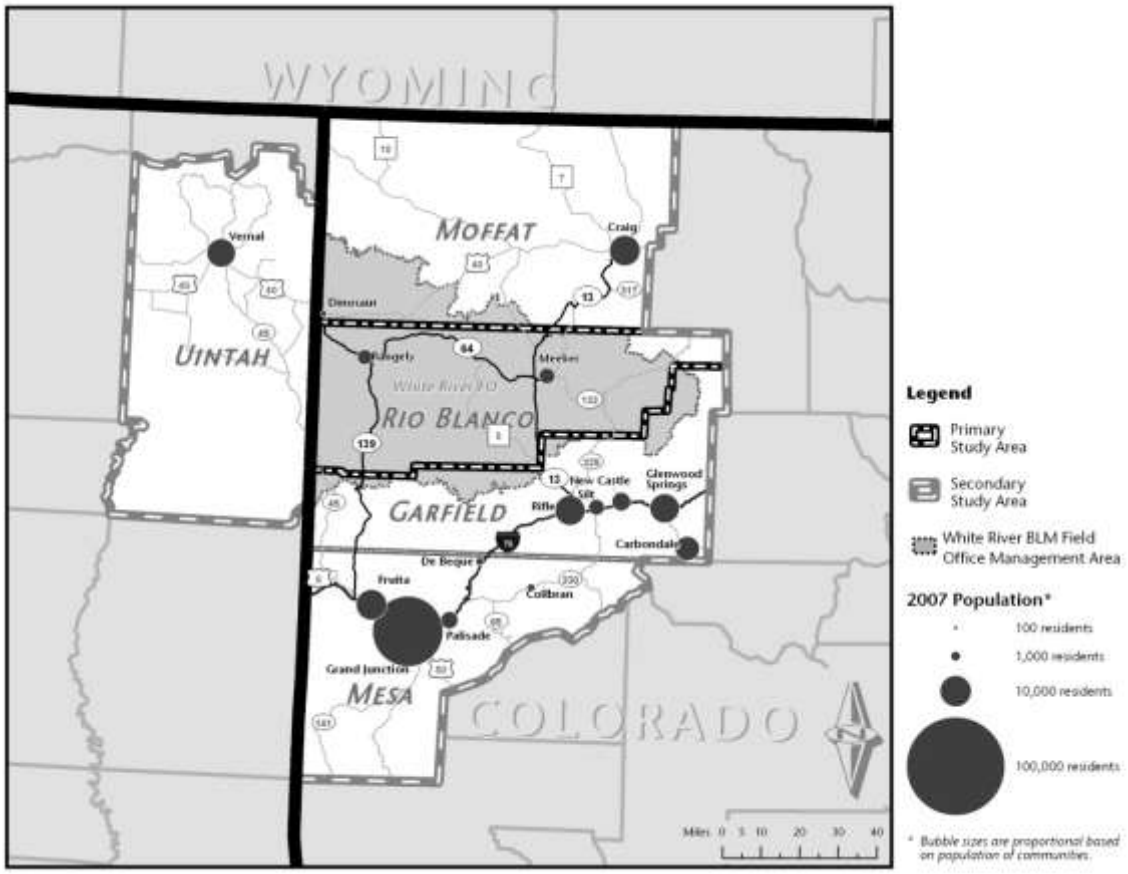
The Secondary Socioeconomic Study Area

The BLM WRFO lies at the center of a large, interdependent economic region that stretches from eastern Utah to the border of Eagle County, Colorado (BBC 2008a; Redifer and Jouflas 2008). This area shares a common economic base of ranching, hunting, tourism, and energy extraction. Grand Junction is the largest service community in the region, but much of the resident population resides in small towns dispersed broadly across this large geographic area. Given current road configurations, portions of Garfield County - particularly the city of Rifle and nearby communities along the I-70 corridor - may also be affected. Rifle, while part of the SSSA, may be substantially affected by BLM management decisions and is discussed in detail. I-70 is the primary transportation corridor but beyond the interstate corridor, road systems are limited. For the purposes of this analysis, this SSSA includes Garfield, Moffat, and Mesa counties in Colorado, and Uintah County, Utah.

Within the SSSA, potential changes to WRFO management and operations would affect the socioeconomic environment, but effects would be diffused because of the long distances and the multiple communities involved. Nevertheless, because of the economic interdependence of this area, it is appropriate to consider this broader region in the socioeconomic evaluation.

Most often data are presented for the "combined study area," which includes both the PSSA and the SSSA. The combined study area, the local road network, and the region's communities (by population) are shown in Figure 3-5, Primary and Secondary Socioeconomic Study Areas and Location of the WRFO Management Area.

Figure 3-5. Primary and Secondary Socioeconomic Study Areas and Location of the WRFO Management Area



SOURCE: U.S. Census Bureau 2007; BLM 2008d.

3.10.1 Social, Economic and Environmental Justice

Social Conditions

This section contains an overview of general socioeconomic conditions in the PSSA and SSSA and a discussion of historical energy development in the region. Recent population, housing, and demographic trends in the area most likely to be affected by changes in BLM WRFO resource management decisions are documented, and a discussion of quality of life issues and concerns, as well as a discussion of current public and educational services is provided.

Overview of General Socioeconomic Conditions in the Primary and Secondary Socioeconomic Study Areas

Rio Blanco County is one of the largest counties in Colorado from a geographic standpoint, but contains only two incorporated municipalities (Meeker and Rangely) and has a population of less than 8,000 persons (SDO 2008). The county is part of a larger socioeconomic area (included in the SSSA) with common economic underpinnings and shared growth opportunities and challenges. In recent years, a rapidly growing natural gas industry has supplemented the area's traditional economic base of energy development (e.g., the Rangely Oil Field), agriculture, tourism, recreation, and retirees.

The PSSA and the SSSA are also influenced by activities along their borders. Resort developments in Pitkin, Eagle, and Routt counties are important economic influences on the east side of the SSSA. Uintah County, Utah shares some economic ties with Grand Junction, and also with Salt Lake City to the west. An expanding natural gas industry in southern Wyoming is also an influence on Moffat County and the town of Craig.

A few geographic characteristics of the PSSA and the SSSA are particularly important in terms of baseline social and economic characteristics as well as potential environmental consequences of management alternatives. They are listed below:

- The combined study area is very rural. Despite its geographic range, the entire area has only about 240,000 residents. Nearly two-thirds of the combined study area's residents live in Mesa County;
- Currently, urbanization is concentrated along the I-70 corridor, which also contains the area's major rail line and the Colorado River. Rio Blanco County, the PSSA, is very large and very sparsely populated;
- Grand Junction is the major regional service center for retail services, professional services, health care, and education; and
- There are only two north/south highways in the entire region: SH 13 between Rifle and Meeker, and SH 139 between Grand Junction and Rangely.

Historical Energy Development

Although Rio Blanco County's economy was originally based on agriculture, the county has a long history of energy development. The Rangely Field, at the western end of the county, began producing oil around 1900. Oil development in Rangely grew more prominent after World War II as demand rose for petroleum products. In the mid-1940s, during a period of field expansion, Rangely was a tent city for a time with a population of as many as 5,000 residents (Thompson and Williams 1990). The local population declined substantially in Rangely after the 1940s oil boom, but the Rangely Field has been produced heavily since that time, using enhanced recovery methods to maintain production. As a result, the Rangely Field has been one of the most prolific sources of oil in the State of Colorado (Athearn 1981; McDonald et al. 2007).

The SSSA also has a history of energy development, and hosts the world's largest deposit of oil shale. The first oil shale boom occurred in 1915 and busted in 1920. Other boom-and-bust periods occurred in the 1940s and 1970s–1980s. In Rio Blanco County, the oil shale booms of the 1940s and the 1970s led to considerable land acquisition by oil companies in the Piceance Creek area, which contains private oil shale resources and is near the federally-owned oil shale deposits (Ekstrom 2008; Lake 2008; Neilson 2008; Brennan 2008). Rio Blanco County also saw a population surge and related effects from oil shale in the 1970s, mainly because of the federal C-a tract and the C-b tract, which are both in the Piceance Creek drainage. The 1970s–1980s oil shale boom, centered in Rio Blanco County, also affected Garfield and Mesa counties to the south. In Rio Blanco County, the boom ended, as it did elsewhere in the SSSA, with a decline to pre-boom population levels, which is where Rio Blanco County remained until the recent renewed interest in the area's natural resources (BLM 2006e).

While the prospect of commercial oil shale production again looms on the horizon, natural gas development has been the dominant factor in recent energy development within the combined study area over the past decade. Energy companies began pursuing Colorado natural gas in earnest in the late 1980s, with drilling and production growing steadily since then and, more recently, at an

increasing pace. According to the BLM, by the end of the 1990s, growth in the Colorado and Utah oil and gas industry was putting local communities under many of the same socioeconomic pressures felt during the 1970s-1980s oil shale boom (BLM 2008f).

Since 2003, drilling and related development of natural gas facilities has accelerated, with many development companies active in northwestern Colorado, including major corporations such as Williams, EnCana, ExxonMobil, ConocoPhillips, and Chevron. The area of development has moved east and north from western Garfield County, and the BLM's RFD scenario for natural gas activity in the WRFO predicts movement north into Rio Blanco County (BLM 2007).

In 2006 and 2007, the COGCC approved 360 and 321 drilling permits respectively for Rio Blanco County, even as Garfield County's total permits grew to 2,550 from 1,844 (COGCC 2008). Activity levels in 2008 were expected to be comparable to 2007. Construction of pipeline and processing facilities also added to industry employment in the area. Projects built in Rio Blanco County alone included completed interstate pipeline segments and large natural gas processing plants needing 500 or more temporary construction workers, with more projects undergoing permitting for projected future development.

Population and Demographics

Growth Trends

Population growth tends to mirror employment trends. Population trends have not been uniform throughout the study region; however, population growth in the region accelerated after the national recession of 1973-1974, stimulated in part by rising energy prices, federal fuels policies, and investment in northwestern Colorado oil shale. Growth was unaffected by the national recessions of 1980 and 1981-1982, but Exxon's closure of the Colony Oil Shale Project in 1982 dealt the region a significant setback, as job losses caused a widespread dispersal from the area (BBC 2008a).

Rio Blanco and Moffat counties were particularly hard hit by the oil shale industry pullout in the early 1980s and took many years to recover. Because of this extended recovery period, Rio Blanco County's average population growth rate was below one percent annually from 1970 and 2006.

In small rural areas, individual construction projects, such as the expansion of I-70 or construction of the Craig electric generating station, unduly influence year-to-year population data. The more diverse economies of Garfield and Mesa counties tend to reduce population fluctuations.

Growth patterns have shifted over the years. In the most recent six-year period, the communities of Fruita, Rifle, and Grand Junction have witnessed the most rapid development. If development accelerates, key residential and retail service centers in the region would likely experience the most notable direct or indirect socioeconomic effects.

Race and Ethnicity

The population within the PSSA and SSSA is relatively homogenous, consisting primarily of white, non-Hispanic residents. In 2000, 95 percent of Rio Blanco County's population identified themselves as racially white; the remaining portion of the population identified themselves as one of the following racial categories: African American, Asian, Two or More Races, "Some Other Race," American Indian, or Native Hawaiian.

Counties within the study areas saw a rise in their Hispanic population between 1990 and 2000, consistent with national trends. Garfield County saw the greatest rise in Hispanic residents,

indicating that overall population growth in the 1990s included a larger proportion of Hispanic residents than was seen in previous decades.

The State of Colorado as a whole contains a larger population of non-white and Hispanic residents than the combined study areas. In 2000, 17 percent of the state identified themselves as non-white, with seven percent identifying themselves as "Some Other Race". Approximately four percent of the population identified themselves as African American, and three percent identified themselves of "Two or More Races." Colorado also contains a larger percentage of Hispanic residents than the study areas; in 2000, 17 percent of Colorado residents were of Hispanic origin (U.S. Census Bureau 2000).

Housing

Housing Trends

It is likely that unincorporated Rio Blanco County and the towns of Meeker and Rangely— the PSSA for this analysis — would be the most immediately and directly affected by the potential for new workforce-related population and related demand for housing as suggested by this RMPA. Given the area's distribution of communities, roads and resources, portions of Garfield County may also be affected, particularly the City of Rifle and other nearby communities along the I-70 corridor. In addition, anecdotes from local interviews suggest that long commutes could occur when local housing is tight near the active natural gas fields in Rio Blanco and Garfield counties (Brown 2008).

Although it required nearly a decade for the region to recover the jobs lost during the mid-1980s, the area eventually stabilized and now supports a larger and more diverse economy. In the 1990s, the area's low cost of living and relatively affordable housing options spurred the in-migration of retirees and persons seeking a different quality of life into the region. In some areas, second homes became an important influence. Rio Blanco County has participated in both the retirement and second home trends. Since the year 2000, increasing natural gas exploration, development and distribution has further bolstered the regional economy.

As noted in Table 3-40, Garfield and Mesa counties capitalized on a strong housing market between the years 2000 and 2006, expanding their current housing stocks by 18 percent and 20 percent, respectively. Within Garfield County, Rifle's housing stock grew by about 25 percent to 3,321 units.

In contrast, Rio Blanco County saw little housing development during this time. The total number of housing units in Rio Blanco County increased by about 6 percent between 2000 and 2006, from 2,855 to 3,021 units. Moffat County was also slow to develop housing during the most recent six-year period.

Table 3-40. Housing Units, Primary and Secondary Socioeconomic Study Area, 2000-2006

Location[1]	Year							Percent Change 2000-2006
	2000	2001	2002	2003	2004	2005	2006	
Rio Blanco County, CO	2,855	2,872	2,897	2,915	2,938	2,977	3,021	6
Town of Meeker	1,054	1,056	1,069	1,076	1,085	1,095	1,111	5
Town of Rangely	899	904	905	906	907	908	908	1
Garfield County, CO	17,336	17,972	18,622	19,117	19,489	19,995	20,525	18
City of Rifle	2,586	2,675	2,795	2,889	2,974	3,110	3,321	25
Mesa County, CO	48,427	50,400	51,811	53,437	54,989	56,541	58,098	20
Moffat County, CO	5,635	5,701	5,749	5,839	5,872	5,943	6,019	7

SOURCE: SDO 2008.

NOTE:

[1]Uintah County, Utah is not included because of the lack of available data

In the past, Garfield County provided affordable housing for the seasonal workforce in nearby Pitkin and Eagle counties. However, a 2006 study released by the Garfield County Building and Planning Department suggested housing was becoming less affordable in the county and commuting to nearby resorts was less common. The study reported that home value appreciation was exceeding increases in average wages, thereby making the median priced home in Garfield County unaffordable for a household earning the county's median household income (Rocky Mountain News 2007). The surge of the energy industry and related service industry jobs, most of which pay higher wages than resort jobs and may not require a lengthy and costly commute, has largely replaced resort employment as a driving factor in SSSA real estate markets.

Vacancy Rates and Housing Prices

Historically, Rio Blanco and Moffat counties have had relatively high vacancy rates over most of the past two decades, while vacancy rates in Mesa and Garfield counties have been comparatively lower, generally staying below ten percent since 1990 (BBC 2008b). Local authorities in both Garfield and Rio Blanco counties report that for-sale housing and rental markets are now very constrained and availability is very low. Housing vacancy in Rifle was reportedly less than one percent in 2007, a rate at which available units among existing housing are extremely difficult to find (BBC 2008b).

Real estate agents report that current demand for Meeker rental housing is high, with supplies of units low, availability "near zero," and rents "very high" (Wix 2008). The availability of this type of housing in Meeker and Rangely has been limited or extremely tight since the fall of 2005 (Blankenship Consulting and Sammons/Dutton 2006).

For-sale housing prices in Rio Blanco County have remained high, reflecting seller expectations of price appreciation in the future (Wix 2008). In the summer of 2008, demand for homes priced under $250,000 was very strong, and homes priced above that level tended to stay on the market for a much longer time (Wix 2008).

Garfield County has the most expensive housing stock within the combined study area. In 2007, Garfield County reported a median home price of $267,368, compared with the much lower home prices in Rio Blanco ($119,589) and Uintah counties ($94,169). Garfield County's housing is also

newer; the median year of construction for Garfield County housing stock was 1986. In Rio Blanco County, the median year of construction for a home was 1975 (Claritas 2008a).

The rising costs of housing and lack of affordable housing are partly blamed by area schools, hospitals, and other agencies for creating difficulties in attracting and retaining qualified teachers, health care professionals, and other skilled employees.

Housing Development Activity, Plans, and Issues

Primary Socioeconomic Study Area
Economic expansion in recent years has led to a modest increase in Rio Blanco County housing starts. Meeker and Rangely have seen steady growth in housing starts since mid-year 2004, but the number of new units remains very small—about 60 units in total in 2007. Land with the potential for subdivision is available in Rio Blanco County and the county is beginning a new comprehensive planning process, which is intended to better define the location and building conditions that are suitable for rural subdivision growth (Brown 2008).

Industry activity has stimulated some subdivision and housing construction in unincorporated Rio Blanco County along SH 64 between Meeker and the intersection of CR 5, which is the main access to ongoing natural gas development. New lots have been developed and housing built in Meeker, where the town's comprehensive plan update of 2005 showed that three-fourths of Meeker's households supported growth as "somewhat" or "very" important (Town of Meeker 2005). Policies in the Meeker Comprehensive Plan recognize the need for rental housing, and the plan's objectives call for a range of development densities (Town of Meeker 2005).

Secondary Socioeconomic Study Area
The City of Rifle is likely to be affected by BLM WRFO management decisions, particularly if population growth rates are high, or communities within the PSSA are unable to expand their housing stock to meet growing population demands. With approximately 9,000 residents, Rifle is the largest city between Glenwood Springs and Grand Junction and is located on one of two north-south highways that provide direct access into the BLM WRFO. Rifle has grown rapidly in recent years as a retail and service center.

Within Rifle, a very large number of housing units (approximately 1,400 single-family and 2,400 multifamily) were in the approval and planning stages as of May 2008. In September 2008, Rifle had over 3,000 homes in the regulatory approval process. For-sale housing availability and rental vacancies have been near zero for the last few years despite aggressive annexations, utility extensions, and the addition of roughly 400 new homes per year over the past three years. Growth pressures have been so strong and workforce so stretched that finalization of the city's comprehensive plan —which is complete at a draft level—has been delayed two years waiting for staff time for final review.

Construction Costs – Combined Study Area
The costs of home building and road construction have risen sharply in recent years in the combined study area. Prices of construction materials have been driven up by strong demand from the energy sector. As a result of increasing costs, bids on public works projects in Rifle have increased by 30 percent over the past three years, and many public works projects receive no bids at all because of contractor and worker shortages (BBC 2008a).

Temporary Workers – Combined Study Area
Another distinctive aspect of the energy development currently taking place in northwestern Colorado is the large number of temporary workers living out of motel rooms and recreational vehicle (RV) campgrounds in the region. Based on 2007 interviews with local visitor bureaus, BBC estimates that between 15 and 30 percent of the approximately 6,800 motel rooms in the four-county northwest Colorado region were continuously occupied by workers associated with regional energy development (BBC 2008a).

Overcrowding – Combined Study Area
Another housing issue within the combined study area has been the use of some units as illegal hot-bunk houses where a large number of industry employees rent the same house and stagger their work schedules so that they can sleep in shifts. Such overcrowding leads to poorly maintained properties, overcrowded streets, and driveways. Some PSSA motels may serve as "man camps," and it is estimated that 80 percent of local hotel room-nights within the PSSA and the nearby City of Rifle in the SSSA are used by energy workers.

Effects on Tourism – Combined Study Area
The scarcity of lodging in some destinations within the combined study area has meant that tourists are searching for temporary lodging in other places. Hunting remains a significant economic generator; however, congestion and the competition for available hotel rooms have caused hunters to look farther afield for accommodations and supplies (BBC 2008c).

Quality of Life Attitudes and Concerns

This section describes "quality of life" attitudes and concerns based upon the public scoping report, recent special studies, local newspaper content, and interviews with selected individuals. The discussion begins with the PSSA, which is the epicenter of potential natural gas development under the RMPA alternatives. The larger SSSA considers the regional quality of life in more general terms. This section concludes with a brief discussion of local and national preservation interests.

Primary Socioeconomic Study Area
Local government officials in Rio Blanco County stated that "county-wide there is a desire to look at growth in new ways" (Redifer et al. 2007). Concerns of residents and local officials over potential impacts to quality of life in the PSSA include:

- Protection of the "western way of life" for residents (Redifer et al. 2007);
- Maintenance of acceptable levels of public service, including law enforcement, fire protection, emergency response, and boards and commissions;
- Additional strain on limited resources, including the business community;
- Temporary and transient workforces;
- Housing and hotel shortages;
- Increased construction activities;
- Demands on water and sewer infrastructure;
- Desire to pursue growth while preserving quality of life;
- Concern about repercussions associated with a future "bust";

- Desire to minimize impacts on agriculture and tourism; and
- Negative aspects of increased traffic.

In the Town of Meeker, many residents identify with a rural lifestyle. To some, new faces in town signal a disruption of community solidarity. The status quo has provided public services and staged signature community events like the annual Range Call Rodeo and the Meeker Classic Championship Sheepdog Trials.

Meeker residents would mostly welcome growth if it is planned and managed, but many are wary of a future "bust" (Day and Sheridan 2007). Meeker's self image emphasizes wildlife, hunting, recreation, and tourism; the town's historically open and agricultural setting has been part of that image. Growth plans for Meeker call for maintaining agriculture and tourism, but new development has tended to occur in unincorporated areas of the county on formerly agricultural land (BBC 2008a).

As energy development has moved north away from Garfield County and into the Piceance Creek area, Meeker has seen more construction activity than ever before. The industry's reliance on temporary workers exacerbates the housing shortage, places new demands on water and sewer infrastructure, and confronts police with more law enforcement and public safety issues. A candidate for the Rio Blanco County Commission identified the most significant issues facing the town as housing needs, infrastructure needs, and quality of life during his recent campaign (Turner 2008).

A faster pace in town has stretched the business community. Mesa State College researchers reported "that the business community is tired. Hotel and motel accommodations are full, due to the needs of energy workers in the area. This recent period of accelerated growth has not let up and residents are concerned about the ability of businesses to withstand the pace" (Redifer et al. 2007). The constant demand for service differs from the pattern associated with Meeker's traditional recreation economy, which eases up after a busy hunting season.

Industrial traffic is affecting SH 13, which runs through town as "Market Street," and could conflict with plans to upgrade the streetscape (Brown 2008). Traffic on the street now includes trucks and equipment, and this carries over to other parts of town. Traffic outside of town also affects quality of life, and safety concerns have arisen about travel on SH 13 from Meeker to Rifle, where town residents go for many kinds of shopping and services.

As changes have occurred in Meeker, concerns have arisen about economic viability in the long run. According to town officials, less than one percent of growth now comes from people building second homes or moving in for the quality of life, but they see change as creating a potential for second homeowners to leave, which could cause a fall in property values and the loss of economic diversity (Day and Sheridan 2007).

The Town of Rangely expresses a willingness to capitalize on growth from natural gas development and has a community capacity to do so, in terms of a view that economic development would promote quality of life. Located further away from the Rio Blanco County epicenter of new natural gas development than Meeker, Rangely strategizes to obtain economic benefits. The difficulties that came from the last boom-and-bust cycle still make the community cautious, but receptive to the possibilities arising from increased economic activity.

One of the areas within the PSSA that has been most affected by the natural gas development activity since 2000 is the area along Piceance Creek Road (RBC 5) in Rio Blanco County. The Piceance Creek ranching area is at a different place today from the community that existed two or three generations ago. Cycles of minerals development and other economic pressures have led to sales of private land, conversion away from agricultural land uses, competing uses on the BLM range land where livestock are grazed, and the construction and presence of large, industrial facilities, especially along RBC 5 itself.

Combined Study Area

Since the end of the 1990s, northwestern Colorado communities have been adapting to the natural gas industry's growing presence. The regional perspective that has emerged since 2003, when natural gas development began to accelerate, often emphasizes the wider region's "quality of life." Summarizing interviews with officials of each county (as described in Redifer et al. 2007) - Mesa, Moffat, Garfield, Rio Blanco, and Routt - four general trends were noted in people's reaction to ongoing change in the quality of life throughout the wider region:

- Urbanization and higher land values have reduced agriculture's viability, changing the culture of the area;
- Long-term residents miss the "small town atmosphere" of the past;
- Many of these same residents find it less satisfying to hunt and fish in their favorite places as development encroaches into wildlife areas; and
- The natural beauty of the area is disrupted as views are marred by drilling rigs and networks of resource roads.

Preservation Interests – Combined Study Area

Environmental preservation messages are pervasive in the larger culture and potentially appealing to a "community of interest" that bridges geographical boundaries. The Wilderness Society (TWS), a national group promoting such a community, participated in public scoping for the WRFO RMPA. Mesa State College researchers observed that "the past history of environmental damage and the forecast of future substantial development of the energy industry makes it easy for preservationists to encourage distrust of the energy industry, and anyone who supports it" (Redifer et al. 2007).

If a national group advocates management actions that disrupt historical uses, there may be local interests who close ranks to oppose it. The issues of wilderness preservation in the WRFO have divided opinion along these lines in the past. During formal public review of the Craig District Draft Wilderness EIS (published as a Final EIS in November 1990), the large majority of comments logged by the BLM favored wilderness designations. At the same time, the Rio Blanco County Commissioners went on record as opposing any wilderness designation at all in Rio Blanco County (BLM 1991). Recently, divisions between outside and local interests over natural resources preservation versus natural resources use were suggested by a recent campaign ad of a winning candidate for a Rio Blanco County commissioner's seat who promised to, "encourage all of the county's industries to work together, managing our natural resources so we do not give any special interest groups a reason to question our way of life" (Turner 2008).

Non-Market Value

Non-market values are often associated with "public goods." Public goods are goods and services that, once provided to one person, can be consumed by another for no additional cost. Despite not being traded in markets, economic theory defines the total economic value of a public good as what

individuals would be willing to pay for all of its attributes. It is difficult to measure total economic value, which can only be inferred from related data by conducting special quantitative analyses.

In some cases, goods that are traded in markets also have non-market attributes that people would be willing to pay for in addition to the costs that show up in the financial transactions. Publicly provided recreation is an example in which recreation visitors may be willing to pay for value that is in addition to what it costs out of pocket (measured by gate fees, travel, and so forth) for the experience of using a recreation area. Productive agricultural land may have value as a public good as well, with people being willing to pay for the character that agricultural land adds to an area that is over and above the dollar value attributed to the land for its ability to produce commodities.

During scoping, participants asked BLM to consider the non-market value of conserving public wildlands and places with wilderness character (BLM 2007a, p. 40-41). The WRFO Planning Area contains six WSAs, three of which have been recommended for wilderness designation. The three WSAs recommended for wilderness contain a total of about 42,000 acres and would potentially support between 2,100 and 2,550 visitor days per year (BLM 1991).

Other resources besides wilderness on BLM-managed and private land in the PSSA could potentially have qualities that generate non-market economic benefits. Abundant wildlife is a well-known example. Another is the area's open landscapes where agricultural activity dominates other types of development. The following discuss these resources as public goods with possible economic value. The discussion does not include a determination of the economic value itself. Instead, it relies on theory and refers to quantitative analyses conducted elsewhere. No studies of non-market value have focused on the PSSA in the past, although the non-market value of natural resources has been studied in Colorado.

Wilderness

Current knowledge about the economic value of wilderness can be summed up by focusing on the published research concerning the "on-site recreation" and "passive use" benefits derived from designated wilderness areas created pursuant to the Wilderness Act of 1964 (Bowker et al. 2005). Three of the six WSAs in the WRFO have the potential to be ratified as part of the National Wilderness Preservation System (NWPS) through an act of Congress.

Recreation benefits accrue to people from their activities in wildness areas, such as fishing, hunting, birdwatching, hiking, camping, and other non-motorized recreation. Passive use benefits (also called "non-use" benefits) "are less tangible than the physical presence of a person being on site and participating in a recreational activity". The authors acknowledge three components of non-use benefits: (1) "Option benefits" accrue to a person because the opportunity to visit a wilderness in the future has been assured; (2) "Bequest benefits" accrue because one knows his or her heirs or future generations will have it available, and (3) "Existence benefits" accrue because one simply knows that a wilderness exists. Citing Freeman (1994, p. 141), the authors say the question of whether non-use value exists is more or less settled:

"While there is some debate among economists over the precise definitions for the various components, and perhaps even more debate as to the empirical measurement of the resulting economic values, most natural resource economists would agree with the concept of passive use benefits." (Bowker et al. 2005).

The Bowker et al. (2005) review of the economics literature identified 14 published studies that quantify "individual consumer surplus[1] for on-site Wilderness recreation" and 8 published studies that quantify the "passive use values of Wilderness." These papers reflect studies from wilderness areas across the country between 1981 and 1999. They were performed as the opportunity presented itself to individual researchers, so they do not represent a systematic wilderness program evaluation.

Table 3-41 is a highly summarized presentation of the findings in Bowker et al. (2005).

Table 3-41. Summary of Published Research Estimates of Non-Market Values for Recreation and Passive Use Benefits of Designated Wilderness in the U.S., 1981 to 1999

Category of Benefits	Denomination (2002 dollars)	Consumer Surplus / Willingness-to-Pay	
		Average / Median	Range
On-Site Recreation Use	Per person per trip for a single day use	$19.50 / $17.99	$12 to $31
	Per person per trip for a multi-day use	$68.47 / $30.11	$5 to $287
Passive Use	Per household per year	$67	$20 to $98

SOURCE: Summarized by Lloyd Levy Consulting LLC from Bowker et al. (2005).

Some of the studies identified by Bowker et al. (2005) focused specifically on wilderness in Colorado. For the Colorado studies, the estimates of per person per trip consumer surplus in 2002 dollars are $31 for single day use (one study) and $94 to $185 for multi-day use (two studies). The Colorado estimates of annual household willingness-to-pay for wilderness ranged from $38 to $98 (2002 dollars, two Colorado-only and two multi-state studies that included Colorado).

The national and Colorado wilderness value estimates should be interpreted with caution. Because of how recreation use value is denominated by Bowker et al. (2005), their findings cannot be used simply as a multiplier in combination with the BLM's standard unit of measurement for recreation use, which is the recreation visitor day.

Wildlife

In Colorado and other western states, the public, through state government, "owns" its wildlife populations. Wildlife viewing on public land is open to the public. The State sells hunting permits, but the permit cost is generally set for management purposes to reflect wildlife's public status and to maintain quality. The price of hunting permits is set to "ration" hunting opportunities and does not necessarily reflect a market-determined economic value for hunting.

Besides permits, hunters make other cash expenditures for goods and services that are part of the price of hunting. People who visit public land to view wildlife make similar travel-related expenditures. These expenditures generate local "economic impacts" when spent away from each participant's home county. However, participants are typically willing to pay more than these direct costs for the satisfaction of hunting and wildlife observation. The total amount that participants would be willing to pay, net of costs, is the measure of wildlife recreation's economic benefits. This is called the net willingness to pay, or "consumer surplus."

[1] Consumer surplus is the dollar amount a person would be willing to pay over and above out of pocket expenditures.

Valuation studies of recreation use, including wildlife recreations, are common nationally, with most studies of hunting and wildlife viewing that have been conducted since 1967 having been conducted in the intermountain region of the U.S., which includes Colorado (Loomis 2005). Table 3-42 presents average values for the consumer surplus of wildlife recreation in the intermountain region. This table also presents the overall U.S. average value. These values represent the economic value received by participants in hunting and wildlife viewing over and above their direct costs of participation.

Table 3-42. Average Consumer Surplus Value per Person per Day by Activity on Public Land Based upon Existing Studies - Intermountain Region, 2004 Dollars

Activity	Intermountain Region Average	United States Average
Hunting	$49	$47
Wildlife Viewing	$37	$42

SOURCE: Loomis 2005.

NOTE: Consumer surplus is the value of a recreation activity beyond what must be paid to enjoy it. The data in the table are based on studies published from 1967 to 2003. The Intermountain Region is a U.S. Forest Service definition that incorporates 12 states, including Colorado (Loomis 2005). Amounts in the table have been rounded to the nearest dollar.

Agricultural Land

Analysts began considering "farmland preservation" in the mid-1980s (Rose 1984). Since then, studies of how open space benefits the citizens of a community have become more common as economists pay more attention to non-market values. The studies generally indicate that the public puts a value on agricultural land for qualities and societal benefits that are in addition to private benefits, though there is debate over how analytical methods affect the reliability of specific dollar estimates (Johnston and Duke 2007).

Community benefits most associated with agricultural land in Colorado are: open space, viewshed, wildlife habitat and lifestyle (Loomis et al. 2000). Methods for analyzing these public benefits are the same as those used to study other types of non-market values. They include (1) observing actual market purchases of agricultural land for preservation by governments and land trusts; (2) analyzing related market transactions to identify land or house price differentials attributable to closeness to agricultural land; and (3) analyzing public perceptions of agricultural land value by using a combination of qualitative and quantitative social research methods (Loomis et al. 2000).

To illustrate the use of market transactions as an indicator of non-market values, Loomis et al. (2000) analyzed purchases by governments and land trusts that led to restricting lands from residential, commercial, and industrial development. The transactions were assumed to represent a societal evaluation of the benefit of preserving certain agricultural lands, given the public or quasi-public character of the buyers. Table 3-43 presents the average price per acre revealed in these conservation purchases occurring in three parts of Colorado.

Table 3-43. Market Transaction Values of Restricting Colorado Lands from Development, 1998 Dollars

	Front Range	Western Slope	Mountains
Total Number of Purchases	51	6	14
Total Acres	19,000	18,800	82,400
Average Cost Per Acre (nominal dollars)	$26,582	$1,889	$3,577

SOURCE: Loomis et al. 2000.

NOTE: These transactions include the state government-sponsored and lottery-funded Great Outdoors Colorado Land Trust (GOCO) and Private Land Trusts. The Colorado Coalition of Land Trusts (CCLT) reported an additional 34 Land Trusts that protected some 518,200 acres on 686 parcels in 1998. Average costs by region were calculated from a subset of the total number of purchases reported above: 39 for Front Range, 5 for Western Slope, and 12 for Mountains. One conservation purchase was also reported for the Eastern Plains.

A study in Routt County in 2004 used a social research method known as contingent valuation to estimate what registered voters would be willing to pay to protect local ranch open space through county government action (Magnan et al. 2005). The estimate of average willingness to pay of up to $220 per person per year was larger than the amount of $182 (inflation adjusted) estimated 10 years earlier (Rosenberger and Walsh 1997). Contingent valuation uses a survey to describe a hypothetical change in a market and then elicit a stated preference for how much the respondent would be willing to pay for the hypothesized benefit.

A related study using contingent valuation in Routt County in 2005 estimated that tourists would spend an average of $210 per person per trip less (median value of $63) because they would spend less and stay fewer days given a change from ranch land to urban use around Steamboat Springs (Ellingson et al. 2006). This result was contrasted with a previous estimate (Rosenberger and Loomis 1999) that predicted no significant impact to tourist spending from the loss of agricultural land in the surrounding area.

Non-use Value

Non-market valuation studies view public lands in terms of their on-site use value and their off-site, non-use, or "passive" use value (all interchangeable terms). Passive users, or individuals who never visit or otherwise use a natural resource, may still perceive themselves to be affected by changes in its status or quality (Harpman et al. 1994). As discussed above, more and more studies from around the country have focused on use values for public goods like hunting and wildlife observation. Fewer studies to date focus on passive use, but the literature includes measures of the passive use value of rare species and natural environments such as free flowing rivers and wilderness.

Wildlife and agricultural open space may also have passive use economic value. Residents, property owners, tourists and potential migrants may put an economic value on wildlife and agricultural open space even if it is outside of a group's usual domain of use or direct experience, as indicated by the Routt County studies already discussed. Compared to a decade earlier, registered voters in Routt County in 2004 seemed be "willing to pay at least as much to protect ranch open space in the area in and around Steamboat Springs and more to protect ranch open space elsewhere in the county" (Magnan et al. 2005). The tourists surveyed in 2005 attributed 56 percent of the economic value they put on ranch open space to vicarious benefits like opportunity to view in the future, potential for upcoming generations to enjoy viewing, knowing that it exists for its own sake, and conserving soil, water, wildlife, and western cultural heritage. They attributed the rest of the value to a mix of market and non-market use benefits like actually viewing, managing growth to reduce dispersed

rural residential development and a source of private enterprise for ranchers and for the local economy (Ellingson et al. 2006).

BLM Management and Non-market Value

There is no existing research quantifying non-market values in the WRFO Planning Area. However, characteristics of the Affected Environment's geography, economy, and social conditions — and some similarities to other areas where non-market valuation studies have been conducted — suggest that BLM management could potentially affect non-market values. The following example, relating public and private resources as they exist in the WRFO Planning Area, illustrates the possibilities for such interaction.

For wildlife populations that may provide non-market values, such as big game animals or other large fauna, the connection potentially exists because seasonal ranges may cover areas that are a mosaic of public and private land. Specific parts of the public domain may have no substitutes elsewhere, so wildlife populations valued for their use or simply for their existence could be affected by land management alternatives.

Public Services

This section contains a description of current (May 2008) public services in the PSSA.

Law Enforcement

The Rio Blanco County Sheriff's Office provides law enforcement services to the unincorporated portions of Rio Blanco County. The county sheriff's department currently employs nine patrol officers: one sergeant and four deputies in the main office in Meeker, and one sergeant and three deputies in the Rangely substation.

Despite accounting for a small proportion of the county's acreage, the Piceance Basin, which houses much of the county's oil and gas activity, has experienced a rapid increase in police reports. In 2003, 135 reports were made from the basin; in 2007, 1,675 calls were made from the basin. As a result, county police staffing needs have changed and the county has added a full-time deputy exclusively for traffic issues (Joos 2008).

Jail

The Rio Blanco County Detention Center is experiencing overcrowding. An area that formerly housed police cars has been adapted into a juvenile detention center, which can hold juveniles for up to two weeks. After two weeks, the underaged inmates are transported to Grand Junction, which requires a deputy chauffeur. This practice is viewed as a temporary solution to the increasing juvenile detention needs. The county conducted a feasibility study in 2006 to determine the configuration, location, and cost for a new 55-bed jail facility. Construction of the new facility has not yet been approved (Joos 2008).

Emergency Management and Response

The Rio Blanco Emergency Manager, a sheriff's office employee, coordinates emergency response planning and training functions for emergency response agencies in the county. Emergency response agencies in the county face a variety of obstacles to provide timely service. These obstacles are listed below:

- The county is large;
- The transportation infrastructure (roads) can be dangerous;

- The large number of recreational visitors in remote areas;
- The proliferation of dispersed energy exploration and development sites; and
- Extensive communication dead spots.

Public Health and Social Services
The Rio Blanco County Nursing Service is the public health agency serving all of Rio Blanco County including the incorporated areas. Services provided include:

- Monitoring of the health status of the population and identification of community health problems;
- Prevention and control of the spread of communicable diseases;
- Promotion of positive health behaviors and environmental practices;
- Mobilization of community partnerships to solve identified health problems; and
- Enforcement of laws and regulations that protect public health and assurance of access to personal health services.

From offices in Meeker and Rangely, the Rio Blanco County Social Services Department administers the following programs:

- Food Stamp Program, Colorado Works Program;
- Medical Assistance Program, Families in Transition;
- Child Support Enforcement;
- Child Protection;
- Adult Protection;
- Child Care Services;
- Old Age Pension;
- Aid to the Needy Disabled;
- Long-term Care, Colorado Employment First; and
- Senior Nutrition (Rio Blanco County 2008).

The social services department has not witnessed a dramatic increase in demand for services, a trend they attribute to slow population growth and an increase in employment opportunities brought about by oil and gas activity in the area (Social Services 2008).

Hospital and Medical Services
Pioneers Medical Center (Pioneers) provides hospital and medical services for Meeker and the eastern portion of Rio Blanco County. It operates a 15-bed hospital and provides 24-hour emergency medical, pulmonary, laboratory, radiological, surgical, acute care, and rehabilitative services. Pioneers operates an attached 33-bed skilled convalescent and long-term care facility. The hospital is designated as a Level IV trauma center and provides advanced cardiac and life-support trauma services.

Pioneers also operates the Meeker Family Health Center, which offers a variety of medical care for children, adults, and families. Four resident physicians provide services through the Meeker Family

Health Center, and staff the hospital and emergency room. The physicians also provide medical direction to Emergency Medical Technicians who staff the ambulance service and provide training to law enforcement and emergency response personnel in the county. The medical center offers industrial medicine services and is currently evaluating options for on-site medical services for energy companies. In addition to the four primary care physicians, another eight or nine physicians visit from neighboring communities and use Pioneers' clinic to provide specialized care.

In September of 2007, Pioneers opened a clinic in the Piceance Basin one day per week to accommodate oil and gas companies requiring pre-employment screenings (Joy 2008).

Additional Services – Combined Study Area

This section describes additional public services provided by Rio Blanco County and municipal governments within the SSSA, including current and planned improvements and fiscal challenges.

Rio Blanco County's expenditures are largely associated with servicing local residents and the local oil and natural gas development activity. Despite modest growth in full-time residents, pressure on county infrastructure and services has grown significantly with increased oil and gas development activity, and associated traffic and commuting workers. Rio Blanco County's largest expenditures are for public works, primarily including road maintenance and repair. The majority of additional general fund revenues expected in 2008 would be applied to expanded public works projects. The county also has a capital expenditure fund, which is separate from the general fund. This fund accounts for most street expansion and highway improvement expenditures.

In addition to the public services previously described for Rio Blanco County, Meeker's general fund includes accounts for public works, parks, community development, economic development, a recycling program, and Build a Generation, a program for prevention of problem behaviors affecting youth in the community. Adding to the general fund is Meeker's water fund, Conservation Trust Fund, and the Walbridge Trust Fund, which funds hospital and nursing home operating costs. In Meeker, some notable recent public improvements and financing issues are identified below (Town of Meeker 2008).

- A new water well was recently drilled, enhancing raw water supply and reliability.
- Major streets were rebuilt and paved with a form of asphalt better suited to accommodating heavy truck traffic. A state energy impact grant and local systems development funds paid for the project, which accounts for 47 percent of Meeker's 2008 expenditures.
- An energy impact grant was used to improve pedestrian access along SH 13, which has had a substantial increase in truck traffic. The street is often crossed by children to get to school or to the park and safety along SH 13 had been a long-standing concern for town officials.
- A task force, comprised of representatives of tax collecting entities, has been assembled to discuss pressing needs related to oil and gas activity. Topics include capital improvement plans and workforce housing needs.
- Sales tax revenues have been volatile in Meeker for a number of years. Despite regional growth, the town's retail base is still very small.
- The receipt of a $350,000 energy implementation and comprehensive plan grant increased the contribution of intergovernmental revenue from previous years (Town of Meeker 2008).

As well as services previously described, Rangely's general fund includes accounts for public works, buildings and grounds, and economic/community development. Additional segregated funds

within the town of Rangely include accounts for water, natural gas, wastewater, the Rangely Housing Authority, housing assistance, the Rangely Development Corporation, the Foundation for Public Giving, and a Conservation Trust Fund. Additional characteristics of Rangely's budget are as follows:

- The town's traditional accounting of annual revenues and expenditures includes capital improvement spending and one-time revenues, which makes year-to-year comparisons difficult.
- Generally, property tax revenue has been stagnant; sales tax revenue has experienced moderate growth since 2006.
- Growth in "miscellaneous revenue" is attributed to a $1.3 million energy rehabilitation loan, administered by the Colorado Department of Local Affairs (DOLA) to improve energy efficiency of the town's housing stock.
- More than $330,000 in severance tax and mineral lease distributions were expected for the proposed 2008 fiscal year (FY).
- Police department and public works spending has consistently accounted for a large proportion of Rangely's expenditures.
- A $1.3 million building and grounds capital improvement project was proposed for 2008 to update insufficient and aging infrastructure.
- Primary concerns in the community are affordable housing opportunities for the town's workforce and an increase in traffic through town, due to oil and gas activity. A traffic study has been conducted on the west side of town to supplement proposed housing projects (Rangely 2008a).

Educational Services

This section contains a description of educational services in the PSSA as of May 2008.

Public Schools

Two school districts cover the majority of Rio Blanco County, including the Meeker School District RE-1 (Meeker RE-1) and Rangely School District RE-4 (Rangely RE-4). Meeker RE-1 covers the eastern two-thirds of the county, including the Piceance Creek project area (CDE 2008).

The 2006 Meeker RE-1 enrollment was 678 students, an increase of 54 students since 2003. Meeker public schools have only recently returned to the enrollment levels reached in 2000, after declines in enrollment between 2001 and 2003 (CDE 2008). Enrollment reduction trends are attributed to an aging population, growth in childless households, and few affordable housing options for younger families. However, with the grade school absorbing much of the district's growth, local officials see some evidence that young families are returning to Meeker to capitalize on well-paying jobs within the oil and gas industry (Town of Meeker 2008).

The grade school facility has reached capacity. A $24 million bond has been sought for a new grade school facility. The middle and high school facilities have adequate space to meet current demands, although repairs and maintenance are needed (Town of Meeker 2008).

Meeker public schools have struggled to maintain staff, as higher paying jobs have drawn workers away from lower paying public service jobs. To attract and retain staff, average salaries have increased. In 2006, the average teacher salary was $44,400, an 18 percent increase from the $37,567

average salary in 2000. By comparison, the average yearly salary for a construction worker in Rio Blanco County was $76,908, nearly 73 percent more than Meeker's teacher salaries.

Rangely public schools have seen a decrease in enrollment in recent years; 2006 enrollment was 478 students, down 26 percent from 2000's enrollment of 643 students (CDE 2008). For this reason, District RE-4 has excess physical capacity and a school building was recently closed as a result of declining enrollment. The number of full-time staff has decreased as student population decreases. In 2000, RE-4 supported 40 staff members; in 2006, 29 full-time staff members were reported (CDE 2008). An improvement project is currently underway to improve the roofs of all three school buildings in RE-4 (Rangely 2008b).

Economic Conditions

This section describes economic conditions as of 2008 in the PSSA and to a lesser extent, the SSSA, including specific conditions related to oil and natural gas development, recreation, livestock grazing, and agriculture. This is followed by a discussion of personal income and poverty. Employment is also discussed, as well as public finance.

Oil and Gas Development

As noted in Section 3.10.1, there is a long history of oil and gas development in the PSSA and the combined study area. More recently, the combined study area has been one of the focal points in the natural gas "boom" that has occurred in northwestern Colorado since 2000. During the past decade, the primary focus of natural gas exploration and production in northwestern Colorado has been in Garfield County, in the SSSA. As of September 2007, the PSSA (Rio Blanco County) accounted for about 1,500 of the 9,500 wells completed since 2000, compared to 6,500 in Garfield County.

Determining the economic contribution of natural gas development activity to individual counties within northwestern Colorado is complicated by differences between the geographic locations of where the activities take place (well locations), where the businesses providing development services (including subcontractors) are based, and where the employees reside. As discussed previously, up to the present time, many of the workers at Rio Blanco County well sites live in nearby counties and many of the businesses are also based elsewhere - primarily in Mesa and Garfield counties in Colorado, as well as Uintah County, Utah.

The socioeconomic analysis and forecasts developed in 2008 for the Associated Governments of Northwest Colorado (AGNC) and DOLA sought to evaluate the varying geographic complexities and estimate the economic effects of natural gas development by location within northwestern Colorado. That analysis estimated that about 1,000 jobs in Rio Blanco County (approximately 23 percent of the total of 4,350 jobs in Rio Blanco County in 2005) were directly or indirectly supported by natural gas development activity in 2005, and the figure was anticipated to more than double by 2010 although the recent economic downturn and falling prices for natural gas may slow development in the near term (BBC 2008a).

There is no way to determine exactly how many of these jobs are related to gas wells located on lands managed by the WRFO. However, the 2007 RFD Scenario indicates that approximately 80 percent of new wells in Rio Blanco County are expected to be located on lands managed by the WRFO (BLM 2007). Recognizing that some of the gas workers that reside in Rio Blanco County also commute out to work on wells located on non-WRFO managed lands in Garfield and Moffat counties, perhaps 50 percent of current oil and gas-related employment in Rio Blanco County stems from development and maintenance of wells and other gas facilities located on lands managed by the WRFO. This proportion is expected to increase in the future as the focus of Piceance Basin

natural gas activity shifts north from Garfield County to Rio Blanco County. Given the fluid relationship between well locations, business offices and worker residences, gas activity on WRFO lands also affects employment in the SSSA, as well as the PSSA.

Recreation

Lands managed by the WRFO provide recreational opportunities for local residents and visitors, and support hunting and fishing activities that are an important part of the economy in the PSSA.

Big game populations and fishing opportunities in the White River and other streams in the PSSA provide an important contribution to the economy in Rio Blanco County. The latest preliminary analysis by CPW indicates that there were approximately 123,000 hunting activity days in Rio Blanco County in 2005, and about 58,000 fishing activity days (an activity day is one individual participating for all or part of a day). Almost one-half of all of the hunting activity days in Rio Blanco County were logged by non-Colorado residents. However, most fishing activity days in Rio Blanco County were by Colorado residents (BBC 2008c).

In 2007, hunting and fishing directly and indirectly led to about $30 million in economic activity in Rio Blanco County and supported over 300 jobs. With nearly 6 percent of total county employment attributable to hunting and fishing, Rio Blanco County is the fourth most dependent on hunting and fishing among Colorado's 64 counties. Only Jackson, San Juan, and Mineral counties have a larger percentage of employment that is attributable to hunting and fishing activity (BBC 2008c).

Approximately 80 percent of the public lands in Rio Blanco County (1.15 million of 1.44 million acres) are managed by BLM. Although the lands managed by the White River National Forest in the eastern portions of the county consist of far fewer acres than the lands managed by BLM, the National Forest lands include important areas for fishing, hiking, and other recreational uses.

Livestock Grazing and Agriculture

Ranches in Rio Blanco County primarily raise cattle, sheep, and horses. One estimate puts the total county-wide livestock inventory at about 40,000 cattle, 20,000 sheep, and 11,000 horses. A few farms in the PSSA, all located within a 20-mile radius of Meeker, still grow grain. In all, the Farm Service Agency (FSA) lists 475 active agricultural producers in Rio Blanco County. These are producers that sell the output of one or more of four types of commodity including livestock, hay, grain, and forage (Lake 2008).

Rio Blanco County ranches function by making use of ownership and use rights on multiple parcels of private and public land. This arrangement has been essential since the end of open range ranching and implementation of the existing permit and quota system. Current permittees must own or lease land proportionate to the number of animals grazed on the public range (Husband 1984).

The WRFO manages 154 grazing allotments that, together, provide forage for over 124,000 AUMs. Most of the BLM land is used for livestock grazing in the spring, summer, and fall.

Over time, difficult conditions for western Colorado agriculture have created pressure to sell off private land as one strategy to sustain a ranching way of life. For example, Piceance Creek ranches have sold land since as early as the 1950s to energy companies seeking land for natural gas field and oil shale development. Sales of ranch lands in the Piceance Creek area have typically not included all of the private ranch lands. In addition, land sales often have been accompanied by a lease-back arrangement that has allowed families to continue to work and live on the ranch (Ekstrom 2008; Lake 2008; Neilson 2008). Despite ownership by energy companies, most Piceance Creek ranches

continue to be run as ranches by the companies, though the energy companies do convert their own ranch lands to industrial use as the need arises.

Personal Income and Poverty

Despite growing wage levels, Rio Blanco County residents continue to trail the State of Colorado in measures of household and personal income. Rio Blanco County is home to a larger proportion of low-earning households than the region as a whole. For example, 13 percent of households in the SSSA earn $100,000 or more per year compared to only nine percent of households in Rio Blanco County (Claritas 2008b). Household income statistics reflect many factors, including the number of persons per household, household age, and the number of workers per household. Rio Blanco County, as well as all counties within the SSSA, trail the State of Colorado in terms of average household income, median household income, and per capita income (U.S. Census Bureau 2000). Of all the counties in the SSSA, Garfield County residents have the highest incomes with a median household income 25 percent greater than Rio Blanco County's corresponding value.

Poverty levels within the SSSA have been consistent with statewide poverty levels. In 2000, 10 percent of residents in the entire SSSA were living below the poverty level, compared with 9 percent of the state's residents. Garfield County reported the lowest county-level poverty rate within the SSSA (7 percent), while Uintah County, Utah had the highest incidence of poverty within the SSSA at 14 percent (U.S. Census Bureau 2000).

Employment

Employment History – Combined Study Area

Rio Blanco County has experienced periods of rapid growth and rapid decline in employment over the past 36 years. Rio Blanco County was particularly hard hit by the termination of the Exxon oil shale project in the early 1980s. The rate of employment growth has recovered in recent years, with employment expanding at a rate of 3.9 percent per year for the period 2000-2006.

The broader region has shown similar patterns. Between 1970 and 2006, employment in the SSSA grew at an average annual rate of 3.9 percent, faster than the 3.2 percent average growth rate for the State of Colorado as a whole (BEA 2008). However, this long-term growth includes considerable short-term economic fluctuations. Perhaps the most memorable single economic event in the region was the rise and subsequent rapid decline of the oil shale industry during the late 1970s and early 1980s.

Although it required nearly ten years for the region to recover the jobs lost during the mid-1980s, the area did stabilize and eventually created a larger and more diverse economy. In the 1990s, the area's low cost of living and relatively affordable housing options spurred the in-migration of retirees and persons attracted by the region's hunting and fishing recreation as well as the affordable lifestyle. In some areas, second homes became an important influence. Since the year 2000, increasing natural gas development has further bolstered the regional economy.

Table 3-44 shows Rio Blanco County's job growth by sector over the 30 year period between 1970 and 2001. Despite gaining 1,500 mining jobs prior to the 1982 oil shale "bust," Rio Blanco County netted only 117 new mining jobs between 1970 and 2000 (BEA 2008).

Table 3-44. Employment Growth by Industry, Rio Blanco County, 1970 and 2000

Industry	Employment		Absolute Change	Annual Change in Percent	Statewide Annual Change in Percent
	1970	2000			
Farm Employment	216	276	60	0.8	0.15
Agricultural services, forestry and fishing	11	*	*	*	6.5
Mining	371	488	117	0.9	0.8
Construction	215	278	63	0.9	4.7
Manufacturing	15	62	47	4.8	2.0
Transportation and public utilities	121	125	4	0.1	3.6
Wholesale trade	19	*	*	*	3.1
Retail Trade	304	507	203	1.7	3.7
Finance, insurance and real estate (F.I.R.E.)	72	174	102	3.0	4.1
Services	333	796	463	2.9	5.4
Government	508	1,146	638	2.7	1.7
All Industries	2,375	4,149	1,774	1.9	3.6

SOURCE: BEA 2008.

NOTE:

* Indicates that data was suppressed and total for all industries may not be summation of individual industries.

Although rich in natural resources, prior to the year 2000, Rio Blanco County employment had not grown as rapidly as neighboring Garfield or Mesa counties, which have better transportation access and more economic diversity. As shown in Table 3-45, since 2000 Rio Blanco County has averaged 4.3 percent job growth per year. This growth rate is similar to the rate of job growth in Garfield County and is greater than the rate of job growth in Mesa and Moffat counties (although slower than the growth rate in Uintah County, Utah). Almost 900 of the 1,021 new jobs added in Rio Blanco County from 2001 to 2006 were in the mining and construction sectors (Colorado Department of Labor and Employment [CDLE] 2008).

Table 3-45. Employment Totals and Average Annual Growth Rate, Combined Socioeconomic Study Area, 1970–2006

Location (County, State)	Total Employment					Average Annual Growth Rate (Percent)			
	1970	1980	1990	2000	2006	1970-1980	1980-1990	1990-2000	2000-2006
Rio Blanco, CO	2,375	4,609	3,653	4,149	5,224	9.4	- 2.1	1.4	4.3
Garfield, CO	6,055	12,262	18,245	29,693	37,255	10.3	4.9	6.3	4.2
Mesa, CO	23,121	43,853	49,881	70,724	83,742	9.0	1.4	4.2	3.1
Moffat, CO	2,916	6,865	6,394	7,365	8,036	13.5	- 0.7	1.5	1.5
Uintah, UT	5,121	9,123	10,057	13,667	17,844	7.8	1.0	3.6	5.1

SOURCE: BEA 2008.

Current Employment – Combined Study Area

Table 3-46 shows current wage and salary positions by county for 2007. Although wage and salary positions are not a full accounting of all employment, these data provide a valuable comparative

profile of both the PSSA and the SSSA. Nearly 50 percent of Rio Blanco County's wage and salary employment is in mining and construction. On a combined basis, a large share of these jobs is associated with the county's older oil fields and more recent natural gas development.

Table 3-46. Number of Wage and Salary Jobs by Industry, Primary and Secondary Study Areas, Year 2007

Industry	Primary Study Area		Secondary Study Area							
	Rio Blanco County, CO		Garfield County, CO		Mesa County, CO		Moffat County, CO		Uintah County, UT	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Agriculture	40	1.0	179	0.7	46.3	0.8	46	1.0	71	0.5
Mining	868	21.0	2,339	8.6	3,017	4.9	639	14.4	3,526	24.6
Utilities	42	1.0	241	0.9	378	0.6	*	*	186	1.3
Construction	1,106	26.8	4,759	17.5	5,902	9.6	264	6.0	1,105	7.7
Manufacturing	48	1.2	411	1.5	3,293	5.4	90	2.0	255	1.8
Wholesale Trade	0	0.0	731	2.7	2,331	3.8	256	5.8	634	4.4
Retail Trade	234	5.7	3,647	13.4	8,480	13.8	735	16.6	1,579	11.0
Transportation and Warehousing	144	3.5	1,055	3.9	2,559	4.2	144	3.2	861	6.0
Information	25	0.6	267	1.0	998	1.6	41	0.9	172	1.2
Finance and Insurance	43	1.0	601	2.2	2,187	3.6	100	2.3	216	1.5
Real Estate and Rental and Leasing	25	0.6	656	2.4	1,222	2.0	44	1.0	390	2.7
Professional and Technical Services	67	1.6	1,194	4.4	2,330	3.8	102	2.3	380	2.7
Management of Companies and Enterprises	*	0.0	144	0.5	91	0.1	*	*	*	*
Administrative and Waste Services	65	1.6	878	3.2	3,078	5.0	164	3.7	340	2.4
Educational Services	296	7.2	2,223	8.2	4,140	6.7	*	*	857	6.0
Health Care and Social Assistance	260	6.3	2,317	8.5	9,037	14.7	470	10.6	964	6.7
Arts, Entertainment, and Recreation	54	1.3	359	1.3	1,067	1.7	90	2.0	141	1.0
Accommodation and Food Services	320	7.8	2,901	10.7	6,156	10.0	492	11.1	953	6.6
Other Services	67	1.6	741	2.7	1,715	2.8	173	3.9	400	2.8
Public Administration	423	10.2	1,562	5.7	3,079	5.0	584	13.2	1,305	9.1
Total	4,127	100	27,205	100	61,523	100	4,434	100	14,335	100

SOURCE: CDLE 2008.

NOTE:

* Indicates that data was withheld due to disclosure concerns.

A comparison of Rio Blanco County's employment distribution with the State of Colorado was made based on the total employment estimates developed by the Colorado State Demography Office. The total employment estimates include proprietors, as well as wage and salary workers.

The 2006 employment comparison indicates:

- Rio Blanco County relies heavily on mining and construction activity. Over 38 percent of the county's employment is in these industries in comparison with 9 percent statewide. This implies that the PSSA has already transitioned from its agricultural roots, and that further development of this kind would not be as transformative as it could be in an area with less mining and construction experience.
- Rio Blanco County's relatively large share of jobs in public administration reflects the small size of the county's economy and the lack of economies of scale in providing government services.
- Conversely, only a small share of Rio Blanco employment is in retail trade, finance, real estate, and other services. This is an indication that a large share of these services currently must be purchased outside of the county.
- Future growth of natural resource development-related employment could produce sufficient scale for secondary jobs to develop in retail and services. This would accelerate the amount of employment and population growth but would also diversify the economy and provide greater retail and service options for local residents.

Unemployment Rates – Combined Study Area
Unemployment rates in the PSSA and portions of the SSSA exceeded 10 percent between 1982 and 1987, following the collapse of the oil shale industry. The regional economy has since stabilized and is now experiencing unemployment rates far below statewide averages. Rio Blanco County's unemployment rates are notably low and many local businesses report difficulty in finding skilled workers (BBC 2008a).

Salaries and Wages – Combined Study Area
The average salary among mining jobs in Rio Blanco is below the statewide average, likely resulting from the inclusion of high-level executive positions located in Denver, Grand Junction, and other metropolitan areas in the statewide average. High demand and highly-skilled labor positions in construction, transportation, and real estate, often associated with energy development, pay relatively well within Rio Blanco County. However, professional positions (e.g., government and educational employees) are paid below statewide averages (CDLE 2008).

Wage trends (net of inflation) from 2001 to 2007 for all wage and salary employment were also examined. All counties in the study area have had wage escalation beyond Colorado statewide averages. In recent years, wage growth in Rio Blanco County has been very high, particularly in relationship to trends in the state, which has experienced very little overall growth in real wage levels (net of inflation). It is also notable that the overall average wage in Rio Blanco County now exceeds the state average. Interviews with Rio Blanco businesses and recent studies in the area suggest that there has been a considerable increase in wages as growing local businesses of all kinds have been forced to compete for local labor in the very isolated area (BBC 2008a).

Public Finance

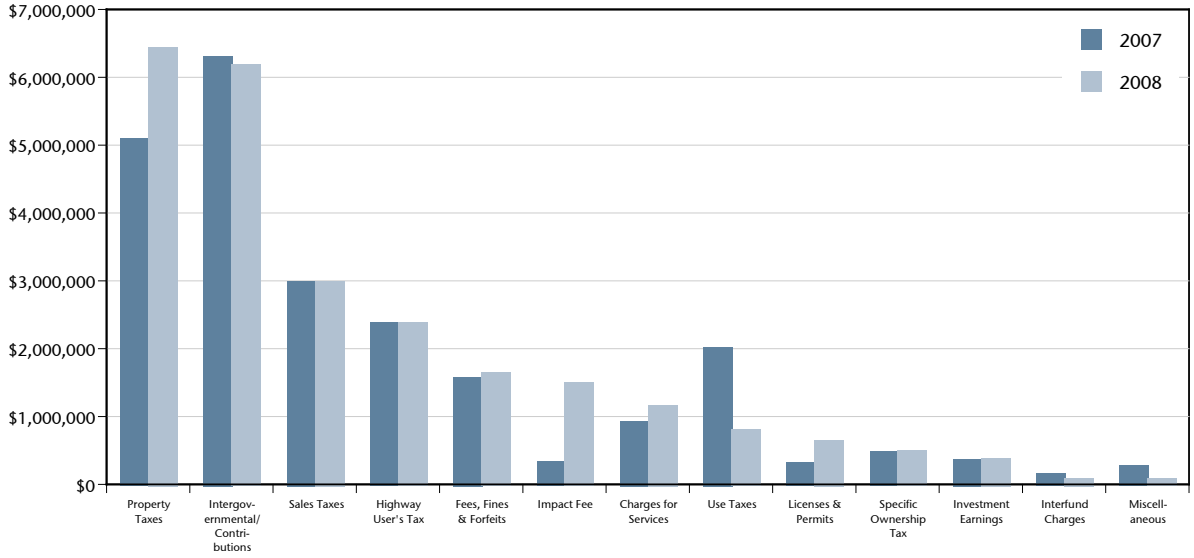
This section describes Rio Blanco County revenues, and issues facing local governments regarding provision of public services.

County Revenues

In 2007, intergovernmental revenues were the largest single category of Rio Blanco County receipts. Intergovernmental revenues are primarily mineral leasing and severance tax funds that are distributed to the county based on the amount of drilling activity and location of employees. County pass-through funds (funds from state sources) for road and bridge and human services are also included in this category (Rio Blanco County 2008).

Impact fees (a charge levied on new development, including new gas wells, in order to recover the capital costs associated with servicing new growth) is a relatively new taxing vehicle that was first applied in part of 2007. As a result, impact fee revenue is expected to rise rapidly in 2008 (Rio Blanco County 2008).

Figure 3-6. Rio Blanco County -- 2007 Estimated and 2008 Proposed Total Revenues by Source



SOURCE: Rio Blanco County Budgets for years 2007 and 2008.

As shown in Figure 3-6, revenue from use tax, which is a form of excise tax applied on certain building materials and equipment imported to Rio Blanco County for use within the county, is budgeted to decrease 60 percent in 2008. This loss is attributable to a dispute over the applicability of use tax to certain natural gas production equipment, which is currently being contested in the state court system (Rio Blanco County 2008).

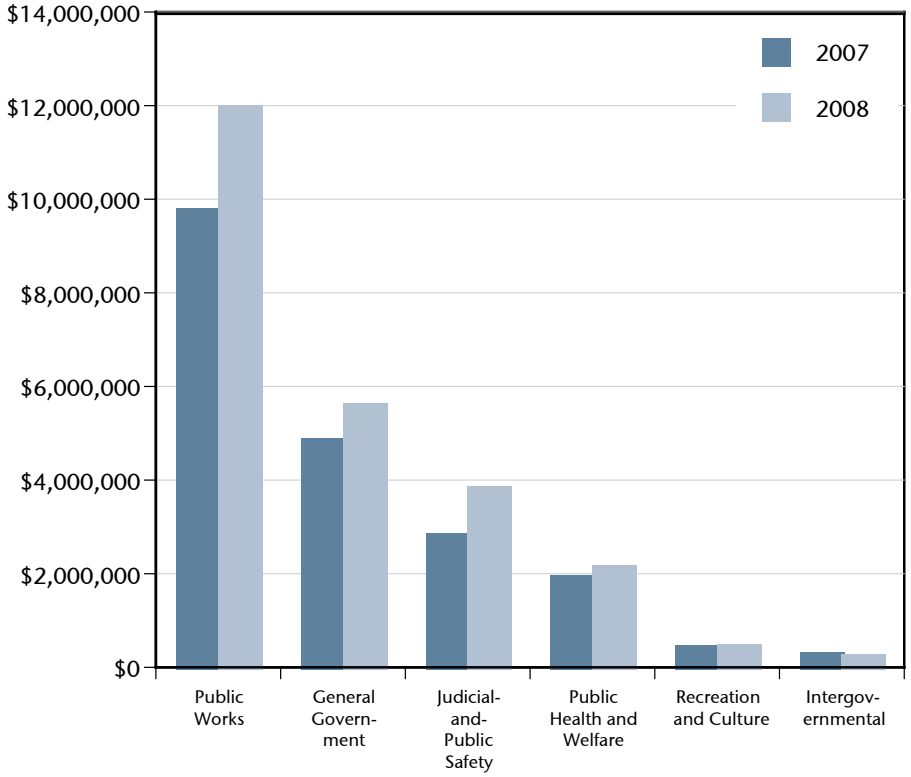
Property tax revenue, the second largest revenue category for the county, is dependent on the assessed value of land and personal property, assessment percentages that are dictated by state law, and the mill levy amount applied for each service entity. In Colorado, the value of natural gas and oil production, along with the value of gas field collection, processing, and transmission facilities, is subject to ad valorem taxes (property taxes) levied by the affected jurisdictions. Total assessed valuation on taxable property in Rio Blanco County has increased sharply over the past several

years, primarily due to the increased natural gas activity in the region. Conversely, the assessed value for agricultural land has decreased, reflecting the county's shift away from agricultural applications (Rio Blanco County 2008). In 2008, the county was anticipating sharp increases in property tax revenues, mostly because of increased oil and gas drilling activity and increased reserve values.

County Expenditures and Services

As shown in Figure 3-7, Rio Blanco County's largest expenditures are for public works, a category that is predominantly road maintenance and repair. The majority of additional general fund revenues expected in 2008 would be applied to expanded public works projects, although as noted below, virtually all service categories are expected to see some expenditure increases. The county's capital expenditure fund, which is separate from the general fund, accounts for most street expansion and highway improvement expenditures.

Figure 3-7. Rio Blanco County -- 2007 Estimated and 2008 Proposed Total Expenditures by Function



SOURCE: Rio Blanco County, 2007 and 2008 Budgets.

According to interviews with county staff and policy makers, Rio Blanco County's expenditures are largely associated with servicing local residents and the local oil and gas activity. Despite modest growth in full-time residents, pressure on county infrastructure and services has grown significantly with drilling activity, and associated traffic and commuting workers. The county also cites "inflationary pressures in salaries and benefits" as a contributing cause to increased expenditures. Salary and benefit expenses increased 30 percent between 2006 and 2007, and the 2008 budget forecast a 13 percent increase from 2007 costs (Rio Blanco County 2008). The county also

expressed difficulty in finding and retaining qualified county workers, who are often lured away to higher-waged jobs in the private sector (Joos 2008).

Issues Facing Local Governments

A recent study conducted by BBC for the AGNC and the DOLA included a summary of issues facing local governments related to service provision in northwestern Colorado (BBC 2008a). This study was intended to facilitate state and local consensus on the nature and magnitude of socioeconomic issues in anticipation of increased energy development activity in the region, as well as prospective oil shale development. Interviews conducted with Rio Blanco County, Meeker, and Rangely staff for this RMPA/EIS confirms that the following issues remain important:

- Municipal growth capacity and related financial support are key issues in Garfield, Rio Blanco, and Moffat counties.
- Accommodating growth in this region is unusually challenging.
- Future natural resource values are highly uncertain, but critical in determining Rio Blanco County tax revenues and service delivery demands.
- Natural gas drilling and extraction activity produces high volumes of traffic in an area with limited road system capacity; this represents a challenging financial situation.
- Housing and worker shortages restrict community development options.
- Funding and timing of critical capital infrastructure, such as roads, water, sewer, and community amenities, are the area's primary fiscal challenges.
- The lag-time between infrastructure need and tax revenue exacerbates funding problems.
- Uncertainty undermines infrastructure investment strategies.
- Resource derived property taxes would increase substantially if new wells come online.
- Federal royalties and severance tax revenue production from northwestern Colorado would grow rapidly as resource extraction increases, but distribution of revenues to northwestern Colorado is uncertain.
- Local ability and willingness to expand self-funding capacity is uneven.

Influence of BLM Lands and Policies

The WRFO of the BLM manages approximately 1.2 million acres of land within Rio Blanco County, or approximately 44 percent of the county's 2.7 million acres. In addition, the BLM manages approximately 232,000 acres of Rio Blanco County split-estate lands, where the federal government controls subsurface mineral rights including oil and gas. The FS manages an additional 247,000 acres in Rio Blanco County. Although the FS manages fewer acres in Rio Blanco County than the BLM, the FS lands include a large share of the public lands with high scenic resource values and high economic value for hunting, fishing, and recreation.

The BLM properties represent the majority of county lands with high oil and gas and mineral values Because of this property and mineral concentration, BLM management policy decisions are critical to the local economy and to governmental revenues. Resource development on public lands is the primary economic opportunity that could produce significant employment and residential growth in the future.

As discussed previously in this section, assuming market conditions and regulatory conditions are attractive, and the BLM allows additional leasing and development of public lands, local job

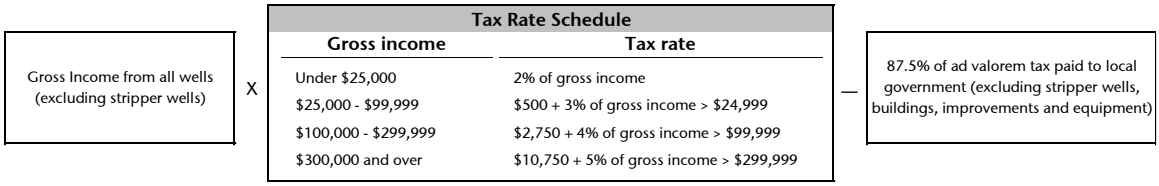
creation and population growth would follow. County revenues are also very sensitive to resource development pace and patterns and thus BLM decisions. Specifically, development of mineral resources on BLM lands would influence production of state severance taxes, federal mineral leasing and bonus revenues, and county revenues from property taxes on mineral development. These revenue sources and the distribution of tax proceeds are described below.

Severance Taxes

Severance taxes are imposed by the State of Colorado on the extraction of non-renewable natural resources from both public and private property. Tax revenue is intended to offset the losses associated with the removal of the state's natural resource.

For oil and natural gas, annual severance taxes are based on gross income produced by all wells except "stripper wells" (those producing less than 15 barrels of crude oil or 90,000 cubic feet of gas per year on average). Calculations method of severance taxes in Colorado is presented in Figure 3-8. Certain production costs, which include transportation, processing and manufacturing costs, are deducted from gross revenue to account for the costs to move the gas from the point of severance (the wellhead; where valuation is supposed to occur) to the point of valuation (usually a regional gas gathering hub). The resultant value is then multiplied by a variable tax rate to determine gross severance tax due. Taxpayers may credit 87.5 percent of ad valorem property taxes paid to local governments on oil and gas production (not including taxes related to stripper wells or taxes on buildings, improvements and equipment) to determine the net severance tax due.[2]

Figure 3-8. Calculation of Severance Taxes, Colorado



SOURCE: BBC Research & Consulting.

Severance Tax Revenue Distribution

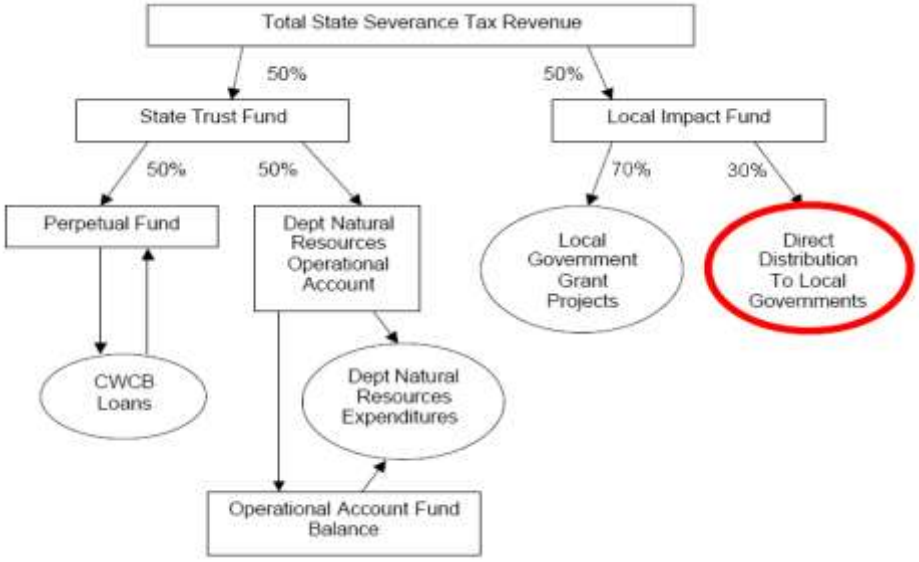
Once collected, severance taxes are distributed through a complex state process. As presented in Figure 3-9, Colorado's severance tax revenues are first split 50-50 between State Trust Fund and the Local Impact Fund. The State Trust Fund provides funding for Water Conservation and Department of Natural Resources operations. The Local Impact Fund gives 70 percent (85 percent prior to 2008) of its collections to a local government grant program that awards funding through a competitive process. The other 30 percent is directly distributed to local governments (15 percent prior to 2008). It should be noted that Federal Mineral Leasing funds (revenues from leasing of federal lands within the state) also accrue to the Local Impact Fund, thus total available funds are more than the severance tax distributions.

This direct distribution to local governments is based on energy employee residency and is designed to offset additional public service and infrastructure costs in areas where these workers live. This distribution translates to a per-resident-employee payment made to a jurisdiction in which industry-specific qualified employees reside. Per capita formulas differentiate between the types of natural

[2] This credit is designed to eliminate the disincentive to invest in counties/jurisdictions with high property taxes.

resource employees; thus, certain industries, such as natural gas extraction, generate more revenue per qualified worker than other industries.

Figure 3-9. Colorado Severance Tax Distribution, 2008



SOURCE: Colorado Department of Local Affairs.

Federal Mineral Lease (FML) Revenue

The Office of Natural Resources Revenue (ONRR) of the U.S. Department of the Interior (DOI) collects mineral lease revenues from the leasing of federal lands used for mineral extraction. Of the total FML revenue collected, the federal government retains approximately half of the revenue and half is returned to the state from which the revenue originated. Each state distributes FML revenue using different methodologies.

FML Tax Rates

For oil and natural gas operations, gross FML revenue is based on three components:

- Rent of $1.50 per acre annually for the first five years and $2.00 per acre annually thereafter.
- Royalties of 12.5 percent of the revenue generated from mineral extraction on these federal lands.
- Bonuses paid by companies to obtain mineral leases, based on a competitive bidding process.

FML Revenue Distribution

Colorado's share of FML receipts are distributed within the state based on a complex formula. Generally, rents, royalties, and interest earnings on the same are allocated in the following manner:

- 48.3 percent of all state mineral lease rent and royalty receipts are sent to the State Education Fund (to fund K-12 education), up to $65 million in FY 2009 – FY 2011, and growing at four percent per year thereafter. Any amounts greater than the upper limit flow to the Higher Education Capital Fund.

- Ten percent of all state mineral lease rent and royalty receipts are sent to the Colorado Water Conservation Board, up to $13 million in FY 2009, and growing at four percent per year thereafter. Any amounts greater than the upper limit flow to the Higher Education Capital Fund.
- 41.4 percent of all state mineral lease rent and royalty receipts are sent to the Division of Local Affairs, which then distributes half of the total amount received to a grant program, designed to provide assistance with offsetting community impacts due to mining, and the remaining half directly to the counties and municipalities originating the FML revenue or providing residence to energy employees.

Bonus payments are allocated separately from rents and royalties, in the following manner:

- 50 percent of all state mineral lease bonus payments are allocated to two separate higher education trust funds: the "Revenues Fund" and the "Maintenance and Reserve Fund". The Revenues Fund receives the first $50 million of bonus payments to pay debt service on outstanding higher education certificates of participation. The Maintenance and Reserve Fund receives 50 percent of any bonus payment allocations greater than $50 million. These funds are designated for controlled maintenance on higher education facilities and other purposes.
- The remaining 50 percent of state mineral lease bonus payments are allocated to the Local Government Permanent Fund, which is designed to accumulate excess funds in trust for distribution in years during which FML revenues decline by 10 percent or more from the preceding year.

Property Taxes

As described previously in this section, property taxes, particularly taxes on mineral reserves, are the largest source of governmental revenues for Rio Blanco County and the local school and hospital district. In Colorado, the value of natural gas and oil production, along with the value of gas field collection, processing, and transmission facilities, is subject to ad valorem taxes (property taxes) levied by the affected jurisdictions. Valuation of mineral resources and production is a complicated process accommodating changing resource values and certain deductions and allowances for costs of production. Property tax revenue flows typically lag mineral production by two years and the uncertainty of mineral values over time introduces a high level of uncertainty in property tax projections.

Environmental Justice

Executive Order 12898 requires all federal agencies to address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, on minority populations and low-income populations. Where the impacts of a proposed federal action could involve such populations, an analysis of the potential for disproportionate impacts and meaningful community outreach and public involvement is required.

The BLM does not manage environmental justice resources; rather, it manages public lands and the resources and uses that occur on them. No specific management issues or concerns related to environmental justice have been identified to date, including during the scoping process.

Minority Populations

BLM IM 2002-164, "Guidance to Address Environmental Justice in Land Use Plans and Related NEPA Documents," provides policy and guidance for addressing environmental justice in BLM

land use planning (BLM 2002). Instruction Memorandum 2002-164 defines minority persons as "Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-white persons." Furthermore, IM 2002-164 indicates that an area should be considered to contain a minority population where either the minority population of the affected area exceeds 50 percent, or the percentage of minority population in the affected area is meaningfully greater than the percentage in the general population.

Race and ethnicity is discussed in Section 3.10.1 above. Table 3-47 analyzes the minority population of Rio Blanco County, Meeker, Rangely, Garfield County, and Rifle, according to data from the 2000 Census. None of these areas are disproportionately high in minorities, as the table shows. In 2000, minorities were a very low percentage of the population of Rio Blanco County and its sub-areas, compared to the Colorado's overall average of 25 percent minorities. Even in absolute terms, Rio Blanco County had few minority residents in 2000 - just 136 individuals. In the county's Census Block-Group 2 (in Census Tract 9511) which defines a geographical area where most of the county's natural gas drilling has occurred recently and could occur in the future, minorities were only 4 percent of the population in 2000. Rifle, which has grown because of recent energy development, had 8.5 percent minorities in 2000, compared to 19 percent in Garfield County. Recent growth trends, which include both resort-related and energy-related growth, have increased Garfield County's minority representation to near the Colorado average.

Table 3-47. Percentages of Minorities in the State of Colorado, Rio Blanco and Garfield Counties, and Selected Areas

	Minority Persons in 2000 as Percent of Total Population	Percentage Points Above/Below the State Average
Colorado	25.5	NA[(1)]
Rio Blanco County	7.4	-18.1
Meeker CCD[(2)]	6.1	-19.4
Block Group 2 (Census Tract 9511)	4.0	-21.5
Meeker	6.1	-19.4
Rangely	8.3	-17.2
Garfield County	19.0	-6.5
Rifle	8.5	-17.0

SOURCE: U.S. Census Bureau 2006a.

NOTES:

(1) NA =not applicable.

(2) CCD=Census County Division

Low-Income Populations

Personal income and poverty are addressed in Section 3.10.1 above. With respect to low-income populations, IM 2002-164 indicates that low-income populations can be identified according to poverty thresholds published by the U.S. Census Bureau. In addition, the IM notes that "when considering these definitions, it is important to recognize that some low-income and minority populations may comprise transitory users of the public lands and thus not associated with a particular geographic area."

The CEQ guidance for environmental justice analysis under NEPA defines a "low-income population" as "either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group

experiences common conditions of environmental exposure or effect" (CEQ 1997). Although CEQ guidance does not provide a quantitative threshold (e.g., a specific percentage of persons in poverty) for determining whether a population should be considered a low-income population, typically the percent of persons in poverty in the study area is compared to that in a comparison area such as the state. Quantitative criteria for what constitutes a low-income population are not specified in BLM, CEQ, or EPA guidance.

Table 3-48 shows the percentage of persons in poverty in Rio Blanco County, its communities and some places nearby. According to the 2000 Census, persons in poverty comprise 10.7 percent of the Meeker Census County Division (CCD), which comprises the eastern half of the county. This is 1.4 percentage points higher than the overall rate for the State of Colorado. However, the area that excludes the Town of Meeker is closer to the state- and county-wide averages.

Table 3-48. Percentages of Persons in Poverty in the State of Colorado, Rio Blanco and Garfield Counties, and Selected Areas

	Persons in Poverty in 1999 as Percent of Total Population	Percentage Points Above/Below the State Average
Colorado	9.3	-
Rio Blanco County(1)	9.6	0.3
Meeker CCD	10.7	1.4
Meeker Town	11.4	2.1
Remainder of Meeker CCD	9.5	0.2
Rangely CCD	8.1	-1.2
Rangely Town	9.8	0.5
Remainder of Rangely CCD	0.7	-8.6
Garfield County	7.5	-1.8
Rifle CCD	6.9	-2.4
Rifle City	7.4	-1.9
Remainder Rifle CCD	7.8	-1.5

SOURCE: U.S. Census Bureau 2006b.

NOTE:

(1) Data on poverty status are not available for small areas like Rio Blanco County Census Block Group 2 (Tract 9511).

Native American Religious and Cultural Concern

American Indians inhabited the study area for thousands of years before European contact. American Indians used the region for hunting, fishing, and collecting plant foods, as well as for religious ceremonies and burial of the dead.

In compliance with the American Indian Religious Freedom Act of 1978, National Historic Preservation Act of 1966, Archaeological Resources Protection Act of 1979, Native American Graves Protection and Repatriation Act of 1990, as well as other Executive and Secretarial Orders, BLM has initiated consultation with Native American Tribes. This consultation is intended to assist BLM in identifying and designing management for significant religious or cultural locations or properties (traditional cultural properties); to understand tribal concerns; to identify public land places, resources, uses, and values that are important to the tribes and/or tribal members (including traditional values and traditional use areas); and to identify land management procedures that conflict with Native Americans' religious observances. In November 2006, BLM sent letters to the

Northern Ute Tribe, Shoshone Tribe (Eastern Band), Southern Ute Indian Tribe, and Ute Mountain Ute Tribe to initiate consultation. To date, Native American entities have not identified traditional use areas or traditional cultural properties in the study area. The BLM will continue to consult with the tribes, as directed by BLM Manual 8120, Tribal Consultation Under Cultural Resource Authorities, and BLM Handbook H-8120-1, Guidelines for Conducting Tribal Consultation.

3.10.2 Public Health and Safety

The BLM's Hazard Management and Resource Restoration Program (HMRRP) objective is to maintain compliance with all applicable laws, regulations, and directives. This objective is achieved by minimizing risks from hazards on public lands and from hazards at BLM-owned or operated facilities, including all hazards not covered under hazardous substances regulations such as physical, geologic, and biologic hazards. The BLM's HMRRP also works to remediate public lands contaminated and restoring natural resources injured by releases of hazardous substances and petroleum products. In addition, the HMRRP works to reduce costs and liabilities through:

- By pursuing potentially responsible parties for contamination of public lands;
- Conducting efficient and effective assessment, investigation, and remediation action;
- Identifying environmental concerns associated with acquisition and disposal of real property;
- Ensuring that BLM-owned or operated facilities are in compliance with environmental laws; and
- Establishing partnerships with States, counties, communities, other Federal agencies and the private sector to prevent pollution by integrating effective environmental management into all BLM activities, authorizations, and business practices.

Activities resulting in health and safety concerns within the Planning Area primarily encompass landslides, proposed and existing industrial hazards, increased vehicular traffic, firearms accidents near oil and gas facilities during hunting season and by casual firearms use such as target shooting, natural events such as range fires, and the release of hazardous and solid wastes.

Hazardous Materials and Wastes

Within the study analysis area, the majority of hazardous material events are the result of spills associated with the exploration and production of oil and gas, and illegal dumping of solid waste. Releases occur at relatively low levels of occurrence and the BLM investigates them as they are discovered to determine the need for immediate cleanup or other long-term remediation actions. This often involves working with the EPA, CDPHE, and potentially responsible parties to fund and expedite the cleanup of hazardous sites and disposal activities that result from recreational use and industrial activities, such as oil and gas development.

Oil and gas development can generate a number of wastes that may be determined to be hazardous materials. However, EPA has exempted most of the waste which in intrinsic to the exploration and by oil and natural gas exploration and production that have an intrinsic association is exempted from regulation as hazardous wastes under Subtitle C of the Resource Conservation and Recovery Act (RCRA). This exemption applies to drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy. Although they are relieved from regulation as hazardous wastes, the exemption does not mean these wastes could not present a hazard to human health and the environment if improperly managed.

Oils and additives are used during well development, and well debris is produced during the process. Additives contained in mud systems used during drilling are often kept in sacks or drums at the sites. Natural gas transportation occurs through a network of pipelines buried 36 to 48 inches deep. Use of 6- to 8 inch-diameter pipelines is common from the well sites, but pipelines ranging from 24 to 36 inches in diameter are more typical for interstate transportation (BLM 2006a).

Management of hazardous materials, substances, and waste (including storage, transportation, and spills) would be conducted in compliance with 29 CFR 1910 (Occupational Safety and Health Standards [OSHS]), 49 CFR 100-185 (Pipeline and Hazardous Materials Safety Administration [PHMSA], DOT), 40 CFR 100-400 (Protection of the Environment, EPA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act, CWA, and other federal and state regulations and policies regarding hazardous materials management. In addition, CERCLA and RCRA exemptions could apply to waste by-products of oil well development and these waste streams would be managed accordingly.

Rio Blanco County does not have a dedicated hazardous materials response team and must rely on agencies in Glenwood Springs, Craig, and Grand Junction for assistance.

Pipeline and Utilities Hazards

Within the analysis area pipeline and utility hazards exist and are associated with areas containing surface or near surface pipelines as well as a number of pre-existing overhead power lines. There are also a number of pre-exiting pipelines which have been exposed due to the proximity of the pipeline to stream systems.

Colorado utilizes a one call preconstruction hotline which identifies any existing pipelines prior to digging or surface disturbance. In areas containing surface or near-surface pipelines, individuals could be exposed to hazardous materials if there were a leak or a failure. The risk of leak or failure could be higher in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities. Compliance with signing requirements for pipeline ROWs and posting markers at frequent intervals along the pipelines would reduce the likelihood of pipeline ruptures caused by excavation equipment. The remoteness of many projects and the low level of anticipated non-project-related construction and excavation would reduce the risk to public health and safety.

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