3 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the existing environment of the Roan Plateau Planning Area (Planning Area), including the physical, biological, human, and management environments (Sections 3.2 through 3.5, respectively). The descriptions provide a baseline against which to compare the impacts under each alternative. Figure 1-1 shows the location of the Planning Area in relation to the region and the State of Colorado. Figure 1-2 shows the land status (ownership and management) of the Planning Area, including Naval Oil Shale Reserves (NOSRs) 1 and 3 and areas with private surface but Federal minerals. Figure 1-3 depicts site topography using a hill shade simulation based on a digital elevation model obtained from the U.S. Geological Survey (USGS). This figure also shows the location of the line used to differentiate between areas referred to as "atop the plateau" versus "below the rim," or similar descriptors.

Information used in the following sections is based on existing Bureau of Land Management (BLM) or other Federal agency publications and reports, as integrated into the Roan Plateau Final Environmental Impact Statement (Roan FEIS). This includes the Glenwood Springs Resource Area (GSRA) Resource Management Plan (RMP), as revised and amended, the 1997 White River Resource Area (WRRA) RMP, the 1999 Final Supplemental Environmental Impact Statement (FSEIS), the Analysis of the Management Situation (AMS) prepared by (the then) Glenwood Springs Field Office (GSFO) staff, and publicly available sources in the published literature or through internet websites. The Colorado River Valley Field Office (CRVFO) conducted internal scoping to determine whether new information was available and whether it was relevant to the Supplemental Environmental Impact Statement (SEIS) analysis. This information is documented in the Analysis of New Information (ANI) and was included as an appendix to the Scoping Report (BLM 2014a). Information determined by the process to be new and significant is summarized in Section 1.3.7.1. Specific references are cited throughout this chapter.

The 1984 GSRA RMP and 1997 WRRA RMP were amended on February 12, 1997, by the Colorado Standards for Public Land Health for all BLM lands in Colorado. These Land Health Standards describe the conditions needed to sustain public land health, and apply to all program uses on public lands. Where applicable, resources described in the following sections are assessed in terms of the Land Health Standards (Roan FEIS, Appendix F).

3.2 PHYSICAL ENVIRONMENT

3.2.1 Geological Resources

Information describing the Affected Environment for Geologic Resources is carried forward from the Roan FEIS.

The Planning Area is located in west-central Colorado, on the northeastern edge of the Colorado Plateau physiographic province. The Planning Area lies west of the Grand Hogback monocline, a northwest-trending feature that separates the Colorado Plateau from the White River Plateau of the Southern Rocky Mountain province to the east (Press and Siever 1974).

The term "Roan Plateau" is a topographic term used to describe the area above (north of) the Roan Cliffs, located north of the Colorado River, west of Government Creek, and east of Parachute Creek. Map 13 is a geologic map of the Planning Area. Elevations range from approximately 5,200 feet above mean sea level (MSL) along the Colorado River to nearly 9,300 feet above mean seal level (AMSL) atop the plateau. The

top of the plateau generally slopes northward and is steeply dissected by generally west-flowing tributaries of Parachute Creek. The eastern, southern, and western edges of the plateau are defined by steep slopes and prominent cliffs, known as the Roan Cliffs.

3.2.1.1 Bedrock and Surficial Geology

Exposed bedrock in the Piceance Basin consists of sedimentary units ranging from Upper Cretaceous (late Mesozoic) to Middle Eocene (early Cenozoic) in age. Bedrock is exposed on dissected uplands, cliffs, and hogbacks. Outcrops in the Planning Area include the upper portion of the Piceance Basin sequence: the Eocene Uinta, Green River, and Wasatch Formations, ranging from 42 to 58 million years in age. The youngest and highest of these, the Uinta Formation, forms the undissected upland surfaces on top of the plateau. The Uinta Formation includes up to 1,000 feet of siltstone with interbedded sandstone and marlstone.

The Uinta Formation is underlain by predominantly lacustrine (lake-deposited) rocks of the Green River Formation, which contains the oil shale for which the area is well known. Deep, narrow stream valleys that dissect the upland surfaces expose the Parachute Creek Member of the Upper Green River Formation, while the older (lower) Garden Gulch Member is exposed in the deepest portions of some of the canyons. The Anvil Points Member is exposed along the high (Roan) cliffs on the eastern and southern edges of the Roan Plateau. Both the Parachute Creek and Anvil Points Members are up to 1,900 feet thick, while the Garden Gulch Member is less than half that thickness. A small amount of the Douglas Creek Member crops out below the Anvil Points Member on cliffs in the southwestern corner of the Planning Area.

The Wasatch (De Beque) Formation—the oldest of the bedrock units exposed within the Planning Area—underlies the Green River Formation and is approximately 6,900 feet thick near the town of Rifle, including a 500-foot exposed section along the Roan Cliffs. Exposed Wasatch rocks include clays and shales with some interbedded sandstone and are found in the lowest elevations of the Planning Area, between the base of the cliffs and the major streams that surround the site (the Colorado River, Government Creek, and Parachute Creek). The Wasatch Formation is one of the strata that produce oil and natural gas in the region. The bottom of the Wasatch Formation is not exposed within the Planning Area, nor is the underlying Late Cretaceous Mesaverde Group. The latter is several thousand feet thick and is the major oil- and gas-producing formation beneath the Planning Area.

Quaternary alluvium occurs as a broad belt along the lower reaches of Parachute, Rifle, and Government Creeks and along the Colorado River (U.S. Soil Conservation Service [Natural Resources Conservation Service] 1985).

Elsewhere in the region, the Grand Hogback exposes Paleozoic and Mesozoic sedimentary bedrock units that dip steeply to the west and southwest. Tertiary basalt flows cover much of the higher elevation areas south of the Colorado River (i.e., Battlement Mesa) and the White River Plateau to the northeast. Volcanic tuffs and some evaporite deposits occur in the Parachute Creek Member of the Green River Formation north of the Planning Area. Glacial deposits are widely distributed throughout the higher elevations of the region, but not within the Planning Area.

3.2.1.2 Anvil Points Claystone Cave

A claystone cave, known as the Anvil Points Claystone Cave, is located below the rim in the south-central portion of the Planning Area (Map 13). A natural arch feature formed of claystone and sandstone in the Wasatch Formation is associated with the cave. Both features are considered unique, fragile, and regionally significant (BLM 2002a).

The cave has been noted as one of the longest verified caves of this type in the world. The cave system is intact and has limited signs of use, most dating back to early recreational users as evidenced by the presence of graffiti at the cave dating to 1947. Research has shown that recreational use and graffiti started with residents and employees from the nearby Anvil Points experimental station (BLM 2002a).

The cave complex poses management concerns regarding public safety as it relates to potential collapses due to drilling and/or seismic activity.

The Anvil Points Claystone Cave has been found to be a significant cave, and receives protection under the Federal Cave Resources Protection Act of 1988 (FCRPA). The Anvil Points Claystone Cave area was leased subsequent to the 1999 FSEIS. The lease has an No Surface Occupancy (NSO) stipulation attached under the FSEIS to protect the cave resources against ground disturbing activities, such as oil and gas drilling, and to avoid difficulties inherent in drilling such locations; surface occupancy is not permitted in the area encompassing the cave openings and subsurface features and the watersheds immediately above the caves. This stipulation does not provide for protection of other resource uses and/or reduce or minimize safety concerns. However, any new stipulations developed under the amended management plan would not apply to these pre-existing leases.

BLM has some concern about highlighting this geologic resource, because increased visits could have a negative effect on the resource conditions and could create a risk of injury associated with visits by inexperienced cavers (spelunkers). Because of this concern, BLM does not make information concerning the specific location of the cave available to the public, pursuant to 5 United States Code (U.S.C.) Section 522 and as stated at 43 Code of Federal Regulations [CFR] 37.

3.2.1.3 Geologic Hazards

The Piceance Basin is a structural basin that trends generally northwest-southeast. The basin is asymmetrical, with steeper dips on the eastern limb. The axis of the Piceance Basin lies generally west of the Planning Area. A baseline characterization of NOSRs 1 and 3 prepared for the U. S. Department of Energy (DOE) (BLM 2006) concluded that no major faults are present within these portions of the Planning Area. One small fault was identified in the Uinta Formation in the northwestern portion of the Planning Area, but this fault was concluded not to represent a geologic hazard. Joints (i.e., fractures in bedrock that do not involve offset [displacement] of rocks) were found to be common in the Planning Area (TRW 1982). While these joints may have posed some hazard to underground mining for oil shale due to instability of rock pillars, they do not pose a seismic (earthquake) risk and would not affect potential oil and gas development or any other anticipated uses of the Planning Area.

Overall, the Planning Area is in an area of relatively low seismic risk (Seismic Risk Zone 1) (Richter 1958). The most severe earthquakes expected within this seismic risk zone correspond to Modified Mercalli intensities V and VI. These intensities could offset small, unstable objects (e.g., items on a shelf) or potentially cause cracks in plaster or masonry.

A more common geologic hazard in the Planning Area is associated with instability of soil and bedrock in areas of steep slopes. The potential hazard from mass wasting is evident when observing the Roan Cliffs, as areas beneath the cliffs are covered with scree, talus, and rockfall from the exposed bedrock due to undercutting of cliffs by erosion of softer underlying strata.

3.2.2 Paleontological Resources

Information describing the Affected Environment for paleontological resources is carried forward from the Roan FEIS; updated with recent new information and data regarding the located fossil record in the Planning Area.

Paleontological (fossil) resources of the Roan Plateau and southern Piceance Creek Basin have been professionally studied since the turn of the 20th century (Armstrong and Kihm 1980). Earl Douglas collected vertebrates for the Carnegie Museum in 1903, followed by Leroy Kay in the 1950s. Vertebrates, invertebrates, and plants were collected for the University of Colorado Museum in Boulder in the 1920s by T.D. Cockerell and from the 1970s to present by Allen Kihm, Peter Robinson, and Paul Murphy. In the 1930s and 1940s, Bryan Patterson collected vertebrates for the Field Museum of Natural History in Chicago. David Kohls worked several localities for the Smithsonian National Museum of Natural History in the 1990s, and later for the University of Colorado Museum of Natural History to 2012. Ivan Kladder's collection from the 1960s went to the Museum of Western Colorado.

Scientific interest in the paleontological record of the Planning Area lies in the major Eocene fossil assemblages that are preserved in a fairly continuous record of deposition of sediments within a closed basin 43 to 52 million years ago. During this time, the Piceance Basin was a tropical to subtropical region teeming with rich floral and faunal ecosystems. Paleontologically, the important rock units comprise three major formations: the Wasatch (De Beque), Green River, and Uinta Formations (oldest to youngest). Each formation intertongues with the overlying formation due to fluctuations in depositional environments, creating a stratigraphic challenge when defining the extent of each mappable unit.

The Wasatch or De Beque Formation is the lowest of the geologic units exposed in the Planning Area. Johnson and May (1978) described three members of the Wasatch in the Piceance Creek Basin. The Atwell Gulch Member is the lowest of the three and is composed of both alluvial plain environments marked by mudstones and channel sands, and a paludal (swamp) environment marked by carbonaceous clays and thin coals. The middle member is the Molina, dominated by fluvial sand facies and conglomeratic lenses indicative of braided stream environments. The upper Shire Member contains both alluvial plain environments with very few channel sands and marginal lacustrine (lake) environments characterized by woody coals. In the Roan Plateau region, the Wasatch is mapped as undifferentiated and identified as the Shire Member only east of Parachute Creek and south of the Colorado River (Hail and Smith 1997).

In the Planning Area, exposures of the Wasatch are found at the base of the cliffs north of the Colorado River (Interstate [I] -70), east of Parachute Creek (County Road [CR] 215), and west of Government Creek (State Highway [SH] 13). Over 180 known fossil localities occur in the Wasatch Formation within the boundaries of the Planning Area. These localities contain rich and scientifically critical terrestrial early Eocene mammal fauna. One of the earliest known rodents, *Paramys*, and the earliest known member of the horse family, *Hyracotherium*, occur in the Wasatch, as do several families of mammals that did not evolve into forms extant today. A common dead-end mammalian lineage was the pantodonts, represented by the tusked hippo-like *Coryphodon*. In addition to the important mammal fauna, flamingo-like birds, horned crocodiles, diverse turtles, and freshwater clams and snails are also common in Wasatch fossil localities.

The Green River Formation is a lacustrine deposit associated with a huge freshwater lake (Lake Uinta) that filled the closed Uinta Basin. The lowest member of the Green River Formation near the Planning Area (and possibly in it) is the Cow Ridge Member. In the western half of the Piceance Creek Basin, the Cow Ridge Tongue of the Green River Formation extends southeastward into the Wasatch Formation. This unit is a mix of sandstone, limestone, and shale of early Lake Uinta. The Cow Ridge Member bears fossils of fish, turtles, crocodiles, flamingoes, and a diverse assemblage of freshwater mollusks (Johnson 1984). It is underlain and overlain by the Wasatch Formation and was arbitrarily terminated as a map unit at Conn Creek, although it extends farther east (Hail and Smith 1997).

The top of the Wasatch Formation is marked by a distinctive persistent gastropod-rich bed known as the Long Point bed of the Green River Formation. This unit signifies the abrupt change from the fluvial

depositional environments of the Wasatch Formation to the lacustrine environments of the Green River Formation (Johnson and May 1978). The bed ranges in thickness from approximately 8 inches to approximately 46 feet and is sandier in the Roan Plateau, where it is less fossiliferous (Johnson 1984).

In the area of the Roan Plateau, the lower Green River Formation consists of the Garden Gulch Member (630 to 720 feet thick) overlying the Anvil Points Member (430 to 470 feet thick), which Duncan and Denson (1949) called the "Douglas Creek Member." The Formation shows the Garden Gulch Member grading into the Anvil Points Member at Wheeler Gulch in the southwestern portion of the Planning Area (O'Sullivan and Hail 1987). Duncan and Denson (1949) called the lower part of the Green River Formation east of Wheeler Gulch the "Lower Sandy Member," where units become less distinctive from one another. However, the unit still bears the characteristic beds rich in algae, oolites, and ostracods seen in the Garden Gulch and Douglas Creek Members and is interpreted as sandy marginal lacustrine to deltaic facies (Johnson and May 1978). These units occur in the steep slopes of the Roan Plateau, below the Roan Cliffs.

The upper member of the Green River Formation is the kerogen-rich (i.e., shale oil-bearing) lacustrine facies of the Parachute Creek Member. This distinctive member is a black, brown, and gray cliff-forming, thinly bedded, organic marlstone that includes the principal oil shale zones of the Green River Formation. This member is exposed just below the top of the plateau and forms the steep, 500- to 1,000-foot-high cliffs and slopes. One of the more distinctive beds in the Parachute Creek Member is the Mahogany Ledge, on which Waldron et al. (1951) based their structural contours, and which is higher to the southwest (at 7,900 feet southwest of Roan Creek) and lower to northeast (7,200 feet at the head of Parachute Creek). The Parachute Creek Member is thickest southward and rises stratigraphically from north to south due to the southward pinchout of three separate tongues of the Uinta Formation, which extend southwest into the Green River Formation.

World-class insect and leaf localities occur in the Parachute Creek Member of the Green River Formation of the Roan Plateau area (Dayvault et al. 1995). Six sites on BLM land and two sites on private land were collected by David Kohls for the Smithsonian Institution between the "A and B groove," lying 150 to 180 feet below the Mahogany Ledge (BLM 2006). The result of those efforts is the largest unbiased collection of any fossil insect community. Over 100,000 specimens of lakeshore insects, spiders, and leaves representing 23 orders and 1,000 to 1,500 species are now curated at the Smithsonian National Museum of Natural History, with many others also at the University of Colorado Museum of Natural History.

Prior to the work of Cashion and Donnell (1974), the top of the Roan Plateau was considered the Evacuation Creek Member of the Green River Formation, but is now recognized as the main body of the Uinta Formation. In the upper part of the Parachute Creek Member of the Green River Formation, and below the main body of the Uinta, lies a thick, complex sequence of inter-tongued units of both formations. To the north, these Uinta tongues thicken and converge into the main body of the Uinta Formation. To the south, the tongues of the Green River Formation thicken and converge into the main body of the Parachute Creek Member (Hail et al. 1997).

The main body of the Uinta Formation is well known in northwestern Colorado, Wyoming, and eastern Utah for its scientifically important mammal fauna. However, paleontological pedestrian surveys within the main body of the Uinta on top of the Roan Plateau have yielded only sparse and scrappy bone fragments (Armstrong 2003). Little paleontological investigation has been done in the complex interval where the many named and unnamed Uinta and Green River tongues interfinger. Some fossil plants were recovered from the sandy units of the Uinta tongues on the eastern side of Parachute Creek during construction of the American Soda Yankee Gulch Pipeline (Bilbey et al. 2001), but no other surveys have been reported from this interval. Paleontologically, these units would be considered areas of good fossil

potential, and the marginal lacustrine environments are likely to bear diverse and densely rich faunal and floral ecosystems.

3.2.3 Soil Resources

Information describing the Affected Environment for soil resources is carried forward from the Roan FEIS. Tables have been updated, as needed, to reflect revisions to Planning Area spatial data since the Roan FEIS was completed, including 2013 soil survey results.

3.2.3.1 General Soil Characteristics

Soils of the Planning Area are described in detail in the soil map of the Rifle area (U.S. Soil Conservation Service [Natural Resources Conservation Service] 1985). The survey covers the Planning Area and includes a general soil map (1:253,440), detailed soil maps of individual 7.5-minute quadrangles on aerial photograph bases (1:24,000), descriptions of soil series and map units, and information useful for detailed soil management planning.

The soil survey mapped and described 44 soil units in the BLM portion of the Planning Area, with 20 dominant soils comprising 97 percent of the area. Soils in the Planning Area can be described in four groups: soils atop the plateau, soils below the rim in the southern and western areas, soils below the rim in the eastern area, and alluvial soils along major drainages. These are described below.

3.2.3.2 Soils Atop the Plateau

Moderately sloping uplands atop the Planning Area, at elevations of 7,500 to 9,300 feet above MSL, are mostly well-drained, cool soils with dark-colored, organic-rich surface layers (Cryoborolls). These soils are formed in material weathered from the Green River Shale and Uinta Sandstone. Surface textures are generally loam, with loam to clay loam subsoils and channery profiles (sandstone and shale fragments). Soil thicknesses range from deep (>60 inches) in swales to shallow (<20 inches) on ridgetops. The principal soil map units above the rim, listed in order of predominance, include:

- Irigul Channery Loam, 9 to 50 percent slopes;
- Northwater Loam, 15 to 65 percent slopes;
- Parachute Rhone Loams, 5 to 30 percent slopes;
- Parachute Loam, 25 to 65 percent slopes;
- Rhone Loam, 5 to 30 percent slopes; and
- Rhone Loam, 30 to 70 percent slopes.

Together, these soils comprise 45 percent of the BLM lands in the Planning Area, or about 30,000 acres. Where slopes are less than 30 percent, most have surface horizons suitable for salvage and use as reclamation material. The Irigul Channery Loam on slopes less than 30 percent is generally less suitable for reclamation due to a high percentage of small rock fragments, although they probably are satisfactory, except where excessively rocky.

The soils on top of the plateau are not particularly susceptible to impacts from wind erosion. In an undisturbed condition, they tend to be relatively well vegetated. Where disturbed, the typically loamy texture, relatively high organic matter content, and granular surface structure tend to resist wind erosion.

Except for a limited area of steep slopes along the East Fork Parachute Creek, all of the upland soils atop the plateau are in the low or medium erosion classes, and most occur on slopes of less than 30 percent. Annual precipitation is about 25 inches, and the average annual temperature is about 40 degrees Fahrenheit (40 °F).

3.2.3.3 Soils Below the Rim, Southern and Western Areas

The escarpment known as the Roan Cliffs marks the boundary between areas above and below the rim. The area below the rim on the southern and western sides of the Planning Area is characterized by cliffs, talus, and steep colluvial slopes of Green River Shale. The area is dominated by shallow, poorly developed soils and rock outcrops, listed as "Torriorthents – Rock Outcrop" map units in the soil survey (U.S. Soil Conservation Service [Natural Resources Conservation Service] 1985). Below the cliffs and talus is a zone of soils formed from colluvium and the Wasatch Formation. This zone includes rock outcrops, badlands, moderately sloping valleys, and fans draining into the Colorado River.

The badlands are steep, nearly barren, and dissected by many ephemeral drainages eroded into soft shales, siltstones, and sandstones. Soils on the upper slopes have a thin, organic-rich surface layer and little development of soil horizons. Soils on the lower slopes range from shallow to moderately deep (20 to 40 inches) and are well-drained. Soils developed from the Wasatch Formation often have loam, clay loam, or silty clay loam surface textures and are moderately alkaline. Subsoils often have higher clay content and are calcareous. Erosion hazard is generally severe.

The principal soils below the rim in the southern and western areas are:

- Rock Outcrop – Torriorthents Complex, Very Steep;
- Badlands;
- Torriorthents – Camborthids – Rock Outcrop Complex, steep; and
- Ildefonso – Lazear Complex, 6 to 65 percent slopes.

Together, these soils constitute 28 percent of the BLM lands in the Planning Area, or 19,000 acres. In general, they have poor reclamation potential due to steep, stony, and/or shallow topsoils and elevated salinity. Except for a few locations where the topsoil of these units may be suitable for salvage and use in reclamation, importation of soil may be needed to facilitate meeting reclamation standards.

In addition to generally less suitable physical or chemical characteristics, these soils occur in areas that are both drier and warmer than soils atop the plateau, with an average annual precipitation of 14 inches and an average annual temperature of 46 °F. The warmer, drier conditions than those found atop the plateau contribute to the poorer reclamation potential of soils below the rim and make these soils more susceptible to wind erosion, due both to the lower soil moisture and the generally sparser plant cover. However, because of the steep slopes on which these soils occur, water erosion is a potentially greater constraint.

3.2.3.4 Soils Below the Rim, Eastern Area

Soils below the rim in the eastern portion of the Planning Area are more complex, occurring on steep mesa breaks and alluvial fans ranging downward to mesas, terraces, and benches. These soils are in a variety of subgroups including Haplargids, Torriorthents, Cryoborolls, Argiborolls, Cryorthents, and Calciorthids. These soils are generally formed in alluvium, with a few formed in residuum derived from shales and sandstone. Some are formed from eolian (wind-deposited) material. Average annual

precipitation ranges from 12 to 14 inches. The soils range from shallow to deep, are well-drained, and have very slow to moderate permeability. Most have loam surface textures underlain by sandy loam to clay loam. These soils are mildly to strongly alkaline and are often calcareous. Erosion hazard is moderate or severe.

The dominant soils below the rim in the eastern area are:

- Cushman – Lazear Stony Loams, 15 to 65 percent slopes;
- Ildefonso Stony Loam, 25 to 45 percent slopes;
- Irigul Channery Loam, 50 to 70 percent slopes;
- Irigul – Starman Channery Loams, 5 to 50 percent slopes;
- Jerry Loam, 12 to 50 percent slopes;
- Villa Grove – Zoltay Loams, 15 to 30 percent slopes; and
- Torriorthents – Rock Outcrop Complex, steep.

Together, these soils constitute 20 percent of the Planning Area, or about 14,000 acres. Typically, these soils are suitable for reclamation, but not particularly good sources of reclamation material for use at other sites. Topsoils of the Villa Grove – Zoltay Loams are suitable for salvage and use in reclamation and typically occur on slopes less than 30 percent. Topsoils of the Cushman – Lazear, Jerry, and Irigul – Starman soils are less suitable for use in reclamation, but are generally satisfactory for salvage on slopes less than 30 percent.

Soils below the rim in the eastern area are somewhat more susceptible to wind erosion than the soils atop the plateau but, with one exception, are not particularly susceptible to wind erosion. This is primarily due to the surface layers, which are mostly gravelly loams with granular texture. The exception is the Ildefonso soil, which is formed from some eolian materials and is expected to be more susceptible to wind erosion than the other soils in the area. In addition, because of the steep slopes on which they occur, water erosion is generally a greater constraint than wind erosion.

3.2.3.5 Soils Along Major Drainages

Soils formed in alluvium derived from sandstones and shales occur on benches, terraces, alluvial fans, and floodplains in the valleys of the Colorado River and Parachute, Government, and Rifle Creeks. These soils are deep, well-drained to somewhat poorly drained, and nearly level to gently sloping. Surface textures range from loam and sandy loam to clay loam, underlain by sandy loam to clay. Precipitation ranges from 12 to 14 inches. Soils are calcareous, moderately to strongly alkaline, and some are highly saline. Permeability ranges from very slow to moderately rapid, and erosion hazard for most soils is moderate, with a few being severe.

Also present along these lower elevations are clayey soils affected by excess sodium and areas where groundwater fluctuates between 2 and 4 feet deep and may be near the surface during spring. Some areas have deep, nearly level, well-drained soils suitable for growing irrigated crops and hay.

The principal soils along the major drainages are:

- Arvada Loam, 1 to 6 percent slopes;

- Arvada Loam, 6 to 20 percent slopes; and
- Silas Loam, 3 to 12 percent slopes.

Together, these soils comprise 3 percent of the Planning Area, or about 2,000 acres. The topsoil of the Arvada Loam is poor, but suitable for salvage. The Silas Loam is a good source of topsoil for reclamation.

The Arvada soil is more susceptible to wind erosion than most of the other soils of the Planning Area. The surface layer is low in organic matter, strongly alkaline, sparsely vegetated, and droughty. The Silas soils are much less susceptible to wind erosion and have organic-rich, well-drained, loam surface horizons.

3.2.3.6 Erodibility

In terms of this Resource Management Plan Amendment (RMPA)/SEIS, the most important soil characteristic affecting future management decisions is erosion hazard or erodibility. While the 2013 soil survey (Natural Resources Conservation Service 2013) describes the erosion hazard of each map unit in broad terms, BLM assigned each map unit to one of four erosion classes based on natural rates of soil loss (Map 14). The average annual soil loss (tons per acre), number of acres within the Planning Area, and general distribution of soils in the four soil erosion classes in the Planning Area are presented in Table 3.2.1 (NRCS 2013). The average loss rates for the four erosion hazard classes are for undisturbed soils in natural or normal situations.

Table 3.2.1 Soil Erosion Classes, Areal Extent, and Location in the Planning Area

Erosion Class	*Soil Loss (tons/acre/year)*	*Acres*	*Principal Location in Planning Area*
Slight	1 to 2	16,030	Gentle, well-vegetated slopes on drainage divides atop the plateau.
Moderate	2 to 5	60,610	Moderate slopes along drainages atop the plateau and broad areas of moderate relief and good vegetation cover below the rim.
Severe	5 to 12	15,900	Moderate to steep slopes with poor vegetation cover on shallow soils and rock outcrops along the cliffs and in gulches extending away from the cliffs; steep slopes of East Fork Parachute Creek canyon.
Very Severe	12 to 30	34,300	Steep slopes with poor vegetation cover in badlands below the rim.

The erodibility of a soil is affected by its inherent tendency for constituent soil particles to become detached and made available for transport, which is related to physical characteristics such as texture and percent organic matter. It is also affected by other site characteristics such as soil type, aspect, slope length and steepness, vegetation cover, and the magnitude and duration of rainfall and snowmelt events.

In 1999, a Land Health Assessment was performed for the area above the rim (BLM 2001d). Physical indicators of soil health and function were assessed at 25 locations, including all of the livestock allotments in the Planning Area. Ten indicators—surface litter (dead remains of previous years' plant growth), soil movement by water, flow patterns, soil movement by wind, soil crusting and surface sealing, compaction layer, rills, gullies, cover amount, and cover distribution—were used to determine upland soil health. Insects and burrowing animals appeared to be mixing the soils, thereby increasing

aeration and mineral recycling. Vegetation cover was excellent. No signs of soil movement, soil pedestals, fills, or litter accumulation were observed. At many sites, the combination of vegetation, rock, and litter cover was at or near 100 percent of the soil surface. This assessment indicates that soils were properly functioning at all of the assessment sites.

In 2001, an interdisciplinary team also evaluated land health at 16 locations below the rim on the eastern side of the Planning Area. Generally, areas of lower elevation in the south were not functioning as well as those to the north. Some of the lower ratings occurred because of naturally limited site potential, but in the Hubbard Mesa allotment, human activities including off-highway vehicles (OHVs), illegal dumping, livestock grazing, and drainage from roads, trails, and constructed facilities had affected soil conditions. OHV use around the JQS Road and to the south and livestock grazing along Government Creek and lower Thirty Two Mile Gulch appear to have had the greatest negative impact on soils. As a result of these disturbances, soils are not meeting the upland soils Land Health Standard (#1) (BLM 2002a). Other allotments (Webster Park, Doodlebug, Magpie Creek, and Rees) are in good condition and meet this standard.

Soils in much of the western Planning Area below the rim are badlands with poorly developed soils, low precipitation, poor vegetation cover, and severe erosion rates. A 2004 Land Health Assessment conducted in the Rifle-West Landscape Unit (BLM 2005b) concluded that all assessed sites in this area below the rim met the upland soil Land Health Standard (#1) on a site-by-site basis. However, some areas across this watershed exhibit accelerated soil erosion. In particular, Cottonwood Gulch has experienced soil erosion from adjacent roads where maintenance activities have pushed soil into the channel.

3.2.3.7 Compaction

Soil compaction is a complex process that depends on the nature of the loading and moisture content of the soil, as well as characteristics such as particle size, organic matter content, structure, and percent of coarse fragments. Soil compaction due to operation of heavy equipment may make soils unsuitable for reclamation that otherwise would be suitable. All of the soil map units described above are susceptible to compaction, particularly when wet. Reclamation potential of the soils is reduced when compacted, generally requiring that the soils be ripped and scarified to restore a condition that allows infiltration of moisture and air and penetration by plant roots.

3.2.4 Water Resources

Information describing the Affected Environment for water resources is carried forward from the Roan FEIS. Tables have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. Additional data and information have been included to further describe the water resource. These include: water resource regulatory requirements; updated discharge and water quality data; updated water quality data for streams, by segment; updated stream classification use attainment for stream segments; water quality standards for stream segments; information on groundwater units and movement in the Roan and Parachute Creeks drainage basins; and instream flow water rights.

3.2.4.1 Surface Water

Planning Objective

Various Federal and State laws regulate surface water quality and yield, including the Clean Water Act, Water Quality Control Act, Colorado River Salinity Control Act, Safe Drinking Water Act, Federal Land Policy and Management Act (FLPMA), Public Land Health Standards, and the regulations set forth by the Colorado Oil and Gas Conservation Commission (COGCC) for energy development. BLM must also comply with Executive Orders, such as *Floodplain Management* and *Protection of Wetlands*. The

regulatory requirements applicable to water resources within the Planning Area are summarized in Table 3.2.2.

Table 3.2.2 Water Resources Regulatory Requirements Applicable to the Planning Area

Regulatory Agency	*Act/Rule/Regulation*
Colorado Department of Public Health and Environment	Clean Water Act (Section 303: Water Quality Standards and Implementation Plans) Colorado Water Quality Control Act: • Water Quality Control Commission Regulation No.31: The Basic Standards and Methodologies for Surface Water • Water Quality Control Commission Regulation No. 37: Stream Classification and Water Quality Standards • Water Quality Control Commission Regulation No. 41: Basic Standards for Groundwater • Water Quality Control Commission Regulation No.85: Nutrients Management Control Regulation • Water Quality Control Commission Regulation No.93: 303(d) List of Impaired Waterbodies
U.S. Department of the Interior Bureau of Reclamation	Colorado River Salinity Control Act, Public Law 93-320
	Public Land Health Standards
U.S. Environmental Protection Agency	Safe Drinking Water Act
Senate and House of Representatives of the United States of America in Congress Assembled	Federal Land Policy and Management Act
President of the United States of America	Executive Order 11988 Floodplain Management
	Executive Order 11990 Protection of Wetlands
Colorado Oil and Gas Conservation Commission	Notice to Operators – June 12, 2008: Roan Plateau Buffer
	Rule 317(b)

Surface water in the Planning Area is currently being managed under guidance from the 1984 GSRA RMP and 1997 WRRA RMP. The planning objectives related to surface water are:

1. 1984 GSRA RMP for public lands below the Roan Plateau Rim:

   ■ Maintain or improve existing water quality in the resource area, where possible.

2. 1997 WRRA RMP:

   ■ Maintain and improve both water quality and quantity to be compatible with existing and anticipated uses and to comply with applicable Federal and State water quality standards; and

   ■ Continue to work with the State of Colorado to identify and survey streams having high public values.

Lands within the Planning Area include portions of the Town of Parachute's Drinking Water Supply Protection Area (DWSPA) (Hill 2013), as shown on Map 18. The DWSPA includes primary and secondary protection zones, which include Colorado River alluvium and areas within a 5-mile buffer zone, respectively. The Town of Parachute is part of the Source Water Protection for the Colorado River Partnership (SWPCRP), which was established for the purpose of providing a framework for public water systems on the Middle Colorado River to identify threats to the drinking water supply and to collaborate on the protection of their drinking water sources from potential sources of contamination. The overall susceptibility rating for the Town of Parachute's source water is moderately high, based on two components: the physical setting vulnerability of the water source and the contaminant threat. The Source Water Protection Plan for the Town of Parachute includes the identification of issues of concern and management approaches and/or best management practices (BMPs) for each (Hill 2013).

COGCC also released a Notice to Operators on June 12, 2008, which presents pit design, construction, and monitoring requirements for locations within 0.75 mile of the Roan Plateau's rim (COGCC 2008b).

Physical Characteristics and Setting

The Planning Area lies within the Upper Colorado River Basin, which encompasses an area of approximately 17,800 square miles. The Colorado River originates in the mountains of central Colorado and flows southwesterly for more than 200 miles into Utah. The topography varies from rugged mountainous regions in the east to high plateaus bordered by steep cliffs along valleys in the west. The climate within the Upper Colorado River Basin ranges from alpine conditions to semi-arid/arid conditions (Spahr et al. 2000).

The climate of the Planning Area is semi-arid, with annual precipitation ranging from 10 inches at lower elevations near I-70 to approximately 25 inches atop the plateau. Peak flow for rivers and streams usually occurs in May. Deeper snowpacks typically delay peak flows, while more shallow snowpacks result in early peak flows. Intense summer cloudbursts are common and can lead to substantial runoff, often representing peak flows in smaller streams.

The Planning Area includes three primary hydrologic areas, as shown on Map 17: (1) Parachute Creek tributaries atop the plateau and in the western end of the area below the rim; (2) Government Creek tributaries below the rim in the eastern part of the site area; and (3) south-trending ephemeral and intermittent gulches and washes that drain most of the area along and below the rim and flow directly into the Colorado River. A small portion in the extreme northeastern corner of the Planning Area drains into mainstem Piceance Creek and Cow Creek, which is a tributary of Piceance Creek. The three primary hydrologic areas are described in more detail below. Stream discharge (flow) and water quality data are provided in Tables 3.2.3 through 3.2.8, presented at the conclusion of Section 3.2.4.1.

Parachute Creek and Tributaries

Parachute Creek flows through a narrow valley of high topographic relief (1,000 feet or more) for most of its length. As it approaches the Colorado River, the floodplain widens and relief becomes more moderate (100 feet to 1,000 feet). Parachute Creek has a sinuous to meandering planform. Channel gradient below the confluence with West Fork Parachute Creek is approximately 2 percent, dropping roughly 900 feet in 10 miles.

The Parachute Creek basin covers approximately 200 square miles and includes nearly all of the area on top of the plateau. Only an area of 548 acres along the northern edge drains into the Piceance Creek basin. Elevations of portions of the basin within the Planning Area range from 9,300 feet on high points north of the cliffs to 5,100 feet at the confluence of Parachute Creek with the Colorado River. Higher elevations atop the plateau, combined with dissected topography and extensive areas of north-facing slopes, result in

a persistent snowpack greater than 3 feet deep in most years. Snowpack accounts for approximately 60 percent of the average annual precipitation on top of the plateau (TRW 1982).

Parachute Creek's main tributaries within the Planning Area are the East Fork and East Middle Fork of Parachute Creek, which TRW (1982) calculated as providing approximately 50 and 45 percent, respectively, of the total annual runoff from NOSR 1 during their monitoring program. Both of these streams have narrow floodplains that widen near their confluence with Parachute Creek. Both are straight to sinuous, with moderate valley relief above their respective falls (where they drop abruptly from the top of the plateau) and high relief below the falls. Channel gradients for these tributaries are approximately 4 to 5 percent. Parachute Creek is a fifth-order stream as it joins the Colorado River.

Based on historical flow data from inactive USGS gages (Table 3.2.3), average annual streamflows in the basin range from less than 0.5 cubic feet per second (cfs) in the headwaters of small tributaries to approximately 32 cfs where Parachute Creek enters the Colorado River. Average peak discharges range from less than 10 cfs in tributaries to 600 cfs near the confluence. Mean low flows range from less than 0.1 cfs in tributaries to approximately 2.7 cfs near the confluence. TRW (1982) reported annual peak flows from April to June as a combination of snowmelt and spring rainfall. After the completion of spring and early summer runoff, flows become more sporadic, depending on the frequency and intensity of summer thunderstorms. Although most of the Parachute Creek basin tributary streams are ungauged, flows are known to be small, consistent with their narrow drainage areas and locations in steep, narrow valleys. For some streams, TRW recorded no flow in late summer and fall.

Streamflows are highly variable not only during each year, but also from year to year. For example, TRW (1982) reported total annual discharges differing by more than an order of magnitude (tenfold) at several gaging stations from 1977 through 1979. This reflects the variability in snowpack from the winter of 1976-1977, which was one of the lowest on record, to that of 1978-1979, which was deeper than average. Similarly, the winter of 2001-2002 had a record low snowfall in most of Colorado, but was followed by a deep and persistent snowpack in the winter of 2002-2003. Adding to the variability in snowpack depth and persistence is annual variability in the timing and amount of spring and early summer rainfall in relation to the timing and rapidity of snowmelt.

Because of this variability, few streams in the Planning Area appear to be perennial (i.e., carrying water throughout the year in all but extreme years), as displayed in the discharge data (Tables 3.2.3 to 3.2.7). Perennial segments of streams atop the plateau are typically in the lower reaches, but some middle reaches are also perennial due to inflow from numerous springs and the presence of numerous beaver dams that act as small impoundments. Many of the beaver ponds have old, unmaintained (inactive) dams that have evolved into more permanent features by infilling of sediments. Upper reaches of tributaries are generally ephemeral, carrying water only in response to snowmelt and heavy or protracted rainfall. Besides Parachute Creek, the other perennial stream reaches (based both on discharge data and the presence of Colorado River cutthroat trout [CRCT] [*Oncorhynchus clarki pleuriticus*] populations [see Section 3.3.4 and Map 22]) include segments of Trapper Creek, Northwater Creek, East Middle Fork Parachute Creek, East Fork Parachute Creek, JQS Gulch, First Anvil Creek, and Second Anvil Creek.

The general pattern for tributary streams is of being gradually more persistent and carrying more flows in the downstream direction due to contributions of runoff from adjacent slopes, inflow from tributaries, and recharge from springs and groundwater (see Section 3.2.4.2). However, this trend does not extend where the streams drop off the plateau to lower elevations below the cliffs east of Parachute Creek. For example, flow data for East Fork Parachute Creek above and below the falls (Table 3.2.3) show lower average baseflows below the falls. Lower baseflows below the cliffs are the result of warmer temperatures and seepage into thicker unconsolidated materials on the valley floors, combined with less runoff from adjacent dry terrain and a lack of spring recharge.

Government Creek and Tributaries

The Government Creek basin has a semiarid climate and covers approximately 50 square miles in a linear configuration between the Grand Hogback and Roan Cliffs. The basin, which includes no portion of the Planning Area atop the plateau, has an annual precipitation of roughly 10 inches. Elevations within the basin range from the high point of Monument Peak at an elevation of 9,196 feet to approximately 5,300 feet at the confluence with the Colorado River in Rifle. No USGS gages are present along Government Creek. Assuming streamflow is directly proportional to basin size, streamflow values can be generally approximated by making comparisons to adjacent basins of similar size, as long as watershed conditions are similar between the basins evaluated. Approximations of mean annual streamflow, average peak discharge, and mean low flow for Government Creek are 15 cfs, 250 cfs, and 2 cfs, respectively. Government Creek is a second-order stream as it joins the Colorado River.

The Government Creek valley becomes wider and less steep as it flows past the eastern edge of the Planning Area. The stream is straight to sinuous and has a gradient of 16 percent near the northeastern corner of the Planning Area, dropping roughly 1,300 feet in 1.5 miles. The stream along most of the eastern edge of the Planning Area is more meandering, with a slope of 2 to 3 percent. Floodplain width is also greater in the lower reaches, and adjacent relief is low (less than 100 feet) as the creek nears its confluence with the Colorado River.

Streams draining eastward toward Government Creek arise along the east-facing portion of the cliffs and are very steep in their upper ends, gradually decreasing in gradient as they approach their confluence. Seasonal flows in these streams are sustained by some snowmelt, but the lower elevations and more exposed terrain than atop the plateau result in highly variable snowpack depth and persistence. Most snowfall melts within a few days. Therefore, peak discharges occur earlier in the spring and summer, although minor snowpack in shaded gulches and seepage from talus slopes tend to delay or prolong these flows. Following peak discharge, these streams are dry, except briefly in response to periods of heavy or prolonged rainfall. Channel stability of these streams is generally poor due to poor vegetation cover and flashy flows. Natural flow characteristics are affected by some irrigation withdrawals.

Colorado River Tributaries

Tributaries to the Colorado River within the Planning Area are typically straight to sinuous channels, with low to moderate relief. Floodplain widths are narrow due to their steep gradients. Typical channel gradients are roughly 3 to 7 percent. Gulches draining to the Colorado River are similar to the Government Creek tributaries in having steep headwater reaches that gradually flatten and broaden at lower elevations. These streams receive very little runoff from snowpack, with most snows melting quickly and behaving like rainfall events. Seepage from talus at the foot of the cliffs is also transitory in response to precipitation events.

Surface Water Quality

Water quality in streams varies throughout the resource area, depending largely on the annual precipitation patterns, vegetation cover, and geology of the watershed. Sediment and, at lower elevations below the cliffs, (Note: WQ exceedances have been documented atop the Roan as well as below the cliffs), salinity, selenium, lead and iron are the primary pollutants. Other parameters of concern include dissolved oxygen, water temperature, and E.coli.

The State of Colorado has established classifications/water quality standards for streams based on existing or potential water uses (Regulation 37) (Colorado Department of Public Health and Environment [CDPHE] 2014). Tables 3.2.9 and 3.2.10, presented at the conclusion of Section 3.2.4.1, list the stream classifications and associated water quality standards, respectively, for streams in the Planning Area and vicinity. Classifications of streams in the Planning Area include: Aquatic Life Coldwater 1 and 2 and

Warmwater 1 and 2; Recreation N, E, and P; Domestic Water Supply; and Agriculture. A comprehensive list of standards for physical, biological, inorganic, and metals parameters has been developed to protect these uses, and is presented by stream segment in Table 3.2.10. The following are summaries of the relevant classifications:

- Aquatic Life:
  - Coldwater and Warmwater Class 1 streams have physical characteristics to support a variety of coldwater and warmwater biota, usually including trout (for coldwater streams);
  - Coldwater and Warmwater Class 2 streams are not capable of sustaining a wide variety of cold or warm water biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that substantially impair species abundance and diversity.
- Recreation: Recreation classifications were revised in 2005 into four new classifications: Recreation Classes E, P, N, and U, as described below:
  - Class E. Existing Primary Contact Use (higher *Escherichia coli* [*E. coli*] standard): These surface waters are used for recreational activities with primary contact, where ingestion of small quantities of water during use is likely to occur (e.g., swimming, kayaking, waterskiing), or where primary contact uses have been documented or are presumed to be present (e.g., the Colorado River);
  - Class P. Potential Primary Contact Use (lower *E. coli* standard): These surface waters have the potential to be used for primary contact recreation. This classification describes water segments for which a use attainability analysis determines that primary contact uses have the potential to occur in the segment, but there are no existing primary contact uses; or no use attainability analysis has been performed demonstrating that a recreation class N classification is appropriate;
  - Class N. Not Primary Contact Use (lowest *E. coli* standard): These surface waters are not suitable or intended to become suitable for primary contact recreation uses. This classification describes water segments where a use attainability analysis demonstrates that there is no reasonable likelihood that primary contact uses will occur within the next 20-year period;
- Water Supply: These waters are classified for domestic water supply and are suitable for drinking with standard treatment. The water supply standard is placed on streams that are suitable for domestic water supply but are not necessarily being used for that purpose; and
- Agriculture: These waters are classified for livestock watering or crop irrigation.

The Colorado 2012 Integrated Water Quality Monitoring and Assessment Report, which is an update to the 305(b) report (CDPHE 2010), compared the classified uses of all surface waters within Colorado to the corresponding standards in order to assess the degree to which waters are in attainment of those standards. The results are presented in Table 3.2.9, including the Integrated Report (IR) categories and use attainment for stream segments within the Planning Area.

The majority of stream segments in the Planning Area were found to be attaining water quality standards (IR Category 1) or attaining some classified uses (IR Category 2), where a complete assessment of all uses cannot be completed due to the lack of data, but the data that are available indicates that at least some of the uses that were assessed are fully supporting. Several stream segments had insufficient data to determine whether the classified uses are being attained (IR Category 3). Two stream segments are not

meeting applicable water quality standards (IR Category 5) for aquatic life, and are listed on the 303(d) List of Impaired Waters for selenium and Monitoring and Evaluation List for *E. coli* (CDPHE 2012e), meaning that any point-source discharge permit would have to use total maximum daily loads (TMDLs) instead of technology-based standards. Inclusion on the Monitoring and Evaluation List indicates that information suggesting impairment is available, but additional information is needed for a final determination. The affected streams include Government Creek and the south-trending ephemeral and intermittent tributaries to the Colorado River between Parachute Creek and Rifle Creek. TMDLs have yet to be established for these stream segments (CDPHE 2012d).

BLM coordinates with the State of Colorado in the location and identification of non-point sources of pollution as an aid in maintaining the established water quality reporting process pursuant to Section 305(b) of the Clean Water Act.

Regulation 85 (CDPHE 2012c) was adopted by the Water Quality Control Commission (WQCC) in 2012 as a statewide nutrient control regulation in an effort to reduce phosphorus and nitrogen loading into Colorado's streams, rivers, lakes, and reservoirs. Regulation 85 represents the first part of a comprehensive plan for phasing in nutrient controls over the next 20 years. In concert with Regulation 85, a second phase to nutrient controls, Regulation 31 (CDPHE 2012a) was amended by the WQCC in 2012 to include "interim" science-based numeric water quality criteria for phosphorus, nitrogen, and chlorophyll (an indicator of aquatic plant and algae growth) for different categories of State waters (Alpine 2014).

Streams Atop the Plateau

Designated classifications and beneficial uses of streams on top of the plateau, including East Fork and East Middle Fork Parachute Creek and their tributaries, are included in Table 3.2.9. Effective September 30, 2013, the Colorado Water Quality Control Commission designated the Lower Colorado River Basin, WQCC Segment 8 (East Middle Fork of Parachute Creek, including all tributaries and wetlands, from the source to the confluence with the Middle Fork of Parachute Creek) (Map 17) as "Outstanding Waters" (OW), which affords such water bodies anti-degradation protections (i.e., waters shall be maintained and protected at their existing quality). This effort was taken, in part, to protect CRCT in Northwater and Trapper Creeks. The Commission found these segments to be critical spawning sites, and considers the protection of this species to be important to the public at large.

Water quality and discharge data collected at USGS gaging stations from 1976 through 1983 (Tables 3.2.3 and 3.2.4) during studies by DOE (Table 3.2.5) (TRW 1982) and during the 1999 Land Health Assessment (Table 3.2.6) (BLM 2001d) show the variable flows and low minimum temperatures characteristic of small streams in areas with cold winters, as evidenced by the substantial snow accumulation atop the plateau. The higher summer temperatures in many of the streams are rather high for coldwater (trout) streams and reflect the combination of small, often slow flows, limited shading for considerable lengths, and contribution primarily by rainfall and shallow groundwater. The pH of these streams is slightly basic. Conductivity values and salinity data (Tables 3.2.6 and 3.2.7) reflect the low quantity of dissolved solids. Suspended loads are usually small, except during peak runoff, or in areas of surface disturbance. Sediment data collected at the inactive USGS gage (1976-1980) on East Middle Fork Parachute Creek resulted in sediment discharge ranging from near zero to approximately 200 tons per day during peak snowmelt, which occurs in April and May, and the concentration drops off rapidly after snowmelt and is less than 2 tons per day from June through early April (TRW 1982).

More recent water quality characterization and monitoring is lacking across the Roan Cliffs landscape. Spot sampling by the BLM, Colorado Division of Water Resources, and other entities have documented several specific exceedances of acute or chronic water quality standards. At this time, no stream segments atop the plateau are listed on the 303(d) List. Additional monitoring is necessary to accurately characterize the extent of the water quality impairments, but parameters of concern include: selenium, iron, lead, dissolved oxygen, *E. coli*, and water temperature. Additional data collection and analysis may warrant new listings of segments on the Monitoring and Evaluation List during the next rulemaking session by the State in triennial reviews.

As part of the development of a watershed plan, the Middle Colorado Watershed Council assembled a surface water quality analysis for the entire Middle Colorado River watershed (Alpine 2014), which included water quality data for streams located within the Planning Area. Table 3.2.8 summarizes the dissolved selenium, total iron, and lead concentrations for streams atop the plateau.

In the East Middle Fork of Parachute Creek (WQCC Segment 8), two of 20 dissolved selenium samples exceeded both the chronic and acute standards, which are 4.6 and 20 micrograms per liter (µg/L), respectively (Alpine 2014). The dissolved selenium concentrations that exceeded the standards were 26 and 67 µg/L in March 2003 and May 2005, respectively. Alpine (2014) states that dissolved selenium concentrations have declined in samples collected since May 2005.

In the East Middle Fork of Parachute Creek above the confluence with Parachute Creek, the water supply standard (300 µg/L) was exceeded in three dissolved iron samples; however, the aquatic life standard was not exceeded.

In Trapper Creek above the confluence with the East Fork of Parachute Creek, the chronic dissolved lead standard was exceeded in two of the four samples collected from June 2008 to August 2011 (Alpine 2014).

In the East Fork of Parachute Creek above Second Anvil Creek (WQCC Segment 12a), one of two dissolved selenium samples exceeded both the chronic and acute standards (18.4 µg/L and 4.6 µg/L, respectively). This location is a tributary to sites on the Lower East Fork of Parachute Creek (WQCC Segments 11e and 11f) and may play a role in the elevated selenium concentrations measured downstream (Alpine 2014). Dissolved lead concentrations exceeded the chronic standard in one sample.

Two samples collected from the middle portion of the East Fork of Parachute Creek (WQCC Segment 11e), roughly 1.25 miles above and below Ben Good Creek, exceeded the chronic standard (20 µg/L) for dissolved selenium, with concentrations of 60 and 62 µg/L, respectively (Alpine 2014). With the existing data set, it is not possible to determine whether selenium concentrations consistently exceeded the chronic standard. Dissolved iron concentrations from samples collected on the East Fork of Parachute Creek exceeded the water supply standard in three samples: once from the site above, and twice from the site below Ben Good Creek (Alpine 2014).

In the lower portions of the East Fork of Parachute Creek (WQCC Segment 11f), near County Road 215, three dissolved selenium concentration samples exceeded the chronic standard (4.6 µg/L), and two of the samples also exceeded the acute standard (18.6 µg/L). At a location about 1.4 miles upstream, in the East Fork of Parachute Creek, dissolved selenium concentrations were below the method reporting limit in eight samples collected to date (Alpine 2014). Based on the existing data set, the East Fork of Parachute Creek may deliver selenium to the mainstem of Parachute Creek. Dissolved iron concentrations collected from the lower East Fork of Parachute Creek exceeded the water supply standard (300 µg/L) in two of 18 samples collected (Alpine 2014). The exceedances occurred during spring runoff in the East Fork of Parachute Creek above the confluence with the Middle Fork of Parachute Creek. In the East Fork of Parachute Creek, immediately above the confluence with the Middle Fork, total iron concentrations exceeded the chronic standard (1,000 µg/L) in one of the four samples (Alpine 2014).

Streams Below the Rim

In contrast to the snowmelt- and spring-fed streams atop of the plateau, streams that originate along and below the Roan Cliffs are warmer (compare May temperatures for these streams [Table 3.2.7] with July and August temperatures for higher elevation streams [Table 3.2.6]). The lower elevation streams also have higher conductivity, salinity, and pH values, reflecting the warmer temperatures, generally lower flows (less dilution from snowmelt or rainfall runoff), and soils derived from different bedrock. Major ions contributing to increased conductivity are calcium, magnesium, and sulfate, with sodium more prevalent at lower elevations. Reduction in vegetation cover due to OHV use and sheep grazing has exacerbated the naturally low cover on the saline/alkaline soils and increased sediment loads. (Note the much higher sediment concentration in Parachute Creek at the two stations below the cliffs reported in Table 3.2.4).

All of the streams below the cliffs are tributaries to the Colorado River, either directly (for streams draining southward; WQCC Segment 4a) or indirectly via Government Creek (for streams draining eastward; WQCC Segment 10) or via Parachute Creek (for streams draining southwestward, including the Middle Fork of Parachute Creek [WQCC Segments 11b, 11c, 11d] and mainstem Parachute Creek [WQCC Segment 11h]). South-trending ephemeral and intermittent tributaries to the Colorado River between Roaring Fork River and Parachute Creek (WQCC Segment 4a) and Rifle Creek (including tributaries; WQCC Segment 10) are included on the 303(d) List for selenium (CDPHE 2012d). This naturally occurring element is a common and widespread component of soils and bedrock formations, such as those that occur in lower portions of the Planning Area, and selenium is often a water quality issue in semi-arid regions. Rifle Creek (including tributaries; WQCC Segment 10) is also listed on the Colorado's Monitoring and Evaluation List for *E. coli*. (Note from Table 3.2.9 that a portion of the Middle Fork of Parachute Creek and Parachute Creek and tributaries to the Colorado are listed as "Aquatic Life Coldwater 2" because of physical limitations of aquatic habitat [warmer temperatures and ephemeral flows] and poorer water quality.) Table 3.2.8 summarizes the water quality data (dissolved selenium and total iron) from Alpine (2014) for stream segments below the rim compared to the streams atop the plateau.

There is only one water quality monitoring site representing the tributaries to the Colorado River coming off the plateau on the south side (WQCC Segment 4a). Data compiled by Alpine (2014) from this site on Cottonwood Creek showed no known exceedances of water quality standards.

In Government Creek (WQCC Segment 10), above the confluence with Rifle Creek, three of the five total iron samples exceeded the chronic total iron standard of 1,000 µg/L (Alpine 2014). The samples that exceeded the standard were collected during August, September, and March, as these months typically characterize low flow conditions. In Government Creek at SH 13, *E. coli* concentrations ranged from 129 to 770 colonies per 100 milliliters (mL) in four samples, and all concentrations exceeded the standard of 126 colonies per mL (Alpine 2014). The samples were collected in August and October of 2011 and March and May of 2012, and tend to characterize a range of flow conditions which may suggest that elevated *E. coli* concentrations persist throughout the year in this portion of Government Creek. Although Government Creek is included on the 303(d) list for selenium under WQCC Segment 10 (East Rifle Creek, West Rifle Creek, and Rifle Creek, including tributaries from Rifle Gap to the Colorado River), the water quality data summarized by Alpine (2014) showed no exceedances of selenium at the Government Creek sampling sites.

On the Middle Fork of Parachute Creek (WQCC Segments 11b), one total iron sample exceeded the chronic total iron standard of 1,000 µg/L, but considering this segment is not designated as water supply, the chronic total iron standard is not applied. On the lower mainstem of Parachute Creek (WQCC Segment 11h), one acute and two chronic dissolved selenium samples exceeded the dissolved selenium acute and chronic standards of 18.4 µg/L and 4.6 µg/L, respectively. Potential selenium sources in this area include the upstream portions of Parachute Creek, the East Fork of Parachute Creek, the produced water treatment facility, and CR 215. Total phosphorus concentrations ranged from 0.01 to 0.58 milligrams per liter (mg/L), with two samples having concentrations above the interim standard, 0.11 mg/L. Total nitrogen concentrations ranged from less than 0.10 to 1.4 mg/L, with one sample exceeding the interim standard of 1.25 mg/L (Alpine 2014).

In March of 2013, a hydrocarbon release associated with Williams Company gas processing plant was discovered within a pipeline right-of-way (ROW) and to the east of Parachute Creek. During an initial assessment, it was determined that the release had reached groundwater. Immediate actions were taken, including removal of impacted soils and installation of interceptor/recovery trenches along the east bank of Parachute Creek (S.S. Papadopulos & Associates, Inc. 2013). Permanent and temporary monitoring wells and a hydrocarbon recovery system were installed in August 2013. Actions were implemented to reduce concentrations of dissolved benzene in the groundwater and to address localized, low levels of benzene in surface water. Benzene was detected above 5 micrograms per liter in one location near the spill site in May and June 2013, but has been less than 1 µg/L since August 8, 2013 (S.S. Papadopulos & Associates 2013). Downstream surface water sampling points, including the Town of Parachute diversion points, have been consistently less than 1 µg/L (non-detect) for benzene and gasoline-range organics (less than 200 µg/L) since testing began. A contingency plan is in place that will trigger additional remedial actions if liquid hydrocarbon or dissolved phase hydrocarbon constituents are detected in the surface water of Parachute Creek.

Table 3.2.3 Historical Stream Discharge Data for Inactive U.S. Geological Survey Gaging Stations, Parachute Creek Basin

Station Name/ Location	*Station Number*	*Period of Record for Streamflow*	*Elevation (MSL) and Basin Area*	*Avg. and Range of Annual Mean Flow[1]*	*Avg. and Max. Annual Peak Flow[1]*	*Avg. and Min. Annual Low Flow[2]*	*Average Annual Yield[1]*
East Middle Fork Parachute Creek	09092850	10/1/76 – 9/30/83 4/25/77 – 5/27/83	7,400 feet (ft) 22.1 square miles (sq mi)	6.2 cfs, 0.6 – 11.7 cfs	170 cfs, 645 cfs	0.23 cfs, 0.09 cfs	4,490 ac-ft
Ben Good Creek	09092980	11/19/76 – 10/6/83 4/9/77 – 5/4/82	6,520 ft 4.0 sq mi	0.5 cfs, 0.001 – 1.1 cfs	7 cfs, 13 cfs	0 cfs, 0 cfs	360 ac-ft
East Fork Parachute Creek (above Falls)	09092960	10/1/76 – 10/7/83 8/25/77 – 5/30/83	7,860 ft 14.5 sq mi	6.7 cfs, 0.6 – 13.7 cfs	139 cfs, 364 cfs	0.38 cfs, 0.07 cfs	4,850 ac-ft
East Fork Parachute Creek (below Falls)	09092970	10/21/76 – 9/30/83 8/25/77 – 1983	6,880 ft 20.4 sq mi	6.5 cfs, 0.1 – 12.6 cfs	146 cfs, 462 cfs	0.02 cfs, 0 cfs	4,710 ac-ft
Northwater Creek	09092830	10/1//76 – 5/16/83 8/19/77 – 5/5/82	Unknown 12.6 sq mi	4.1 cfs, 0.5 – 7.5 cfs	84 cfs, 225 cfs	0.25 cfs, 0.01 cfs	2,970 ac-ft
Parachute Creek below East and West Forks	09093000	10/1/48 – 9/30/86 5/4/49 – 4/24/86	5,770 ft 141 sq mi	33.3 cfs, 1.8 – 121.0 cfs	464 cfs, 2,310 cfs	1.81 cfs, 0 cfs	24,110 ac-ft
Parachute Creek at Parachute	09093500	4/1/21 – 9/30/82 5/17/21 – 10/15/81	5,100 ft 198 sq mi	31.9 cfs, 4.8 – 65.5 cfs	606 cfs, 2,600 cfs	2.71 cfs, 0 cfs	23,090 ac-ft

Source: USGS 2014 http://waterdata.usgs.gov/co/nwis/sw

Notes:
[1] Gaps in data exist for stations 09092970, 09093000, and 09093500.
[2] Approximations of low flows using daily average flows.

Table 3.2.4 Historical Water Quality Data for U.S. Geological Gaging Stations, Parachute Creek Basin

Station Name/ Location	*Station Number*	*Period of Record*	*Temperature (C)*	*pH*	*Conductivity (microSiemens per centimeter[µS/cm])*	*Suspended Sediment Conc. (milligrams per Liter [mg/L])*	*Suspended Sediment Load (tons/day)*
East Middle Fork Parachute Creek	09092850	2/76 – 7/83	0 – 16.5	7.3 – 9.3	415 – 800	--	--
Ben Good Creek	09092980	11/76 – 9/83	0 – 20	7.1 – 8.7	390 – 680	--	--
East Fork Parachute Creek (above Falls)	09092960	2/76 – 9/83	0 – 16.5	7.7 – 8.8	350 – 675	1 – 279	0.01 – 33
East Fork Parachute Creek (below Falls)	09092970	4/77 – 9/83	0 – 19	7.3 – 8.8	380 – 1,250	10 – 654	0.1 – 127
Northwater Creek	09092830	2/76 – 5/83	0 – 21	7.7 – 8.6	380 – 697	10 – 61	0.01 – 1.0
Parachute Creek below East and West Forks	09093000	9/64 – 9/86	0 – 22	7.2 – 9.2	202 – 1,150	1 – 2,940	0.01 – 4,170
Parachute Creek at Parachute	09093500	11/74 – 10/82	0 – 21.5	7.3 – 8.9	520 – 2,300	10 – 5,670	0.44 – 4,850

Source: USGS 2014 http://waterdata.usgs.gov.co.nwis.

Table 3.2.5 U.S. Department of Energy Discharge and Water Quality Data for Naval Oil Shale Reserve 1 Streams

Stream/Location	*Sampling Period*	*Flow (cfs)*	*Temp. (C)*	*Conductivity (μS/cm)*	*pH*
Ben Good Creek	seasonal, 1981	0 – 7	2.5 – 15.5	490 – 580	7.3 – 8.2
East Fork Parachute Creek below First Anvil Creek	seasonal, 1981	0.1 – 119	0 – 18	410 – 680	7.1 – 8.4
East Fork Parachute Creek below Falls	seasonal, 1981	0 – 52	0 – 15.5	305 – 490	7.7 – 8.3
East Middle Fork Parachute Creek	seasonal, 1981	0.2 – 95	0 – 24.5	322 – 601	7.9 – 8.5
Northwater Creek	seasonal, 1981	0 – 81	0 – 17	380 – 530	8 – 8.5
Parachute Creek at Town of Parachute	seasonal, 1981	0 – 560	0 – 32	395 – 2,550	7.5 – 8.5
Parachute Creek below East and West Forks	seasonal, 1981	0 – 390	0 – 34	375 – 910	7.6 – 8.6
Trapper Creek (1 sample)	Sept. 1981	0.5	15.5	560	8.7

Source: TRW 1982.

Table 3.2.6 BLM Discharge and Water Quality Data for Some Streams Atop the Plateau

Stream/Location	*Date*	*Flow (cfs)*	*Temp. (C)*	*Conductivity (µS/cm)*	*pH*	*Salinity (parts per thousand [ppt])*
Ben Good Creek	8/25/99	0.15	14.7	504	8.8	0
Bull Gulch	7/12/99	0.01	19.0	169	8.9	0
Camp Gulch	7/12/99	0.01	17.0	189	8.7	0
East Fork Parachute Creek	7/12/99	1.50	15.0	382	9.0	0
East Forked Gulch	8/24/99	0.14	22.0	520	8.5	0
Golden Castle Gulch	8/24/99	0.02	12.5	389	8.5	0
JQS Gulch	8/24/99	0.03	12.5	518	8.0	0
Northwater Creek	7/06/99	1.20	22.6	445	-	0
Raspberry Creek	7/13/99	0.06	18.5	369	8.2	0.10
Second Anvil Creek	8/24/99	0.02	24.5	567	7.6	0
Sheep Trail Hollow	8/24/99	0.02	21.0	410	8.2	0
Third Water Gulch	8/25/99	0.05	14.7	416	8.8	0
Trapper Creek	7/06/99	0.41	20.2	451	-	0
West Forked Gulch	8/24/99	0.15	17.5	507	8.4	0
Yellowjacket Creek	7/13/99	0.14	18.0	372	8.6	0.25

Source: BLM 2001d.

Table 3.2.7 BLM Discharge and Water Quality Data for Some Streams Below the Cliffs

Stream Name	*Date*	*Flow (cfs)*	*Temperature (°C)*	*Conductivity (σS/cm)*	*pH*	*Salinity (ppt)*
Doodlebug Gulch	5/7/01	0.001	11.50	1,630	8.4	1.30
Goodrich Gulch	5/7/01	0.004	6.50	710	8.5	0.75
Government Creek above JQS Road	5/7/01	1.97	23.00	1,100	8.4	1.00
Government Creek near 32 Mesa Rd	5/7/01	1.60	20.00	1,305	8.6	1.00
Thirty-Two Mile Gulch – upper reach	5/7/01	0.07	15.00	1,080	8.5	0.80
Thirty-Two Mile Gulch above SH 13	5/8/01	0.001	27.00	1,750	8.5	0.50
Magpie Gulch	5/8/01	0.66	5.00	610	8.4	8.00
Piceance Creek	5/16/01	2.10	15.00	695	8.4	0.50
Government Creek south of Rio Blanco	5/16/01	0.20	16.00	1,150	7.6	0.80
Government Creek near Magpie Gulch	5/23/01	0.26	11.00	1,730	8.6	1.20
Government Creek below Magpie Gulch	5/23/01	0.53	12.00	1,400	8.6	1.10

Table 3.2.8 Water Quality Data for Streams within the Planning Area

Stream Name WQCC Segment	*Date Range*[1]	*Dissolved Selenium µg/L*	*Dissolved Iron µg/L*	*Dissolved Lead µg/L*
WQ Standard		*Acute 18.4 Chronic 4.6*	*300 1,000 (Total Chronic)*	*Hardness-Dependent Equation*
Streams Atop the Plateau				
Segment 8 Trapper Creek and East Middle Fork of Parachute Creek	2003-2011	<10 – 67	<50 – 1,000	<3 – 10.1
Segment 12a East Fork of Parachute Creek (upper)	2007-2011	<5 – 28.3	--	3 – 10.4
Segment 11e East Fork of Parachute Creek (mid)	2005-2006	<MRL – 62	<100 – 6,100	--
Segment 11f East Fork of Parachute Creek (lower)	2004-2008	<MRL – 27	10 – 10,000 27 – 2,300 (total)	--
Streams Below the Rim				
Segment 10 Government Creek	2011-2012	No exceedances	110 – 11,000 (total)	--
Segment 11b Middle Fork of Parachute Creek	2000-2007	<10	10 – 13,000 (total)	--
Segment 11h Parachute Creek	2004-2007	<10 – 26	--	--

Source: Alpine 2014.

Note:
[1] Date range varies based on parameter.

Key:
MRL = method reporting limit: the smallest "less-than" value reported for a parameter when it either is not detected or is detected at a concentration less than what is a reliable measurement given the analytical method
-- = not available in cited report.

Table 3.2.9 Stream Classifications and Use Attainment for Stream Segments Located within the Planning Area

WQCC Stream Segment	*Stream Segment Description*	*Classification*	*Numeric Standards List*[1]	*Integrated Report - Use Attainment Category*[2]		*Additional Listing/ Designations*
11c	Mainstem of the Middle Fork of Parachute Creek including all tributaries (includes Davis Gulch and tributaries), from the source to the north boundary line of S19, T5S, R95W.	Aquatic Life Coldwater 2	E	3	NA	
		Recreation N			NA	
		Agriculture			NA	
11b	Mainstem of the Middle Fork of Parachute Creek from the north boundary line of S19, T5S, R95W to the confluence with East Middle Fork of Parachute Creek.	Aquatic Life Coldwater 2	E	1	FS	
		Recreation N			FS	
		Agriculture			FS	
11d	Mainstem of Middle Fork of Parachute Creek from the confluence with East Middle Fork to a point immediately above the confluence with the West Fork of Parachute Creek.	Aquatic Life Coldwater 1	D	1	FS	
		Recreation N			FS	
		Agriculture			FS	
8	Mainstem of Northwater and Trapper Creeks, including all tributaries and wetlands, from their sources to the confluence with the East Middle Fork of Parachute Creek. East Middle Fork of Parachute Creek, including all tributaries and wetlands, from the source to the confluence with the Middle Fork of Parachute Creek.	Aquatic Life Coldwater 1	A	2	FS	OW
		Recreation N			NA	
		Water Supply			FS	
		Agriculture			FS	
12a	All tributaries to East Fork Parachute Creek from its source to a point immediately below the mouth of First Anvil Creek.	Aquatic Life Coldwater 1	D	3	NA	
		Recreation N			NA	
		Agriculture			NA	
11a	Mainstem of East Fork of Parachute Creek, including all tributaries and wetlands, from a point immediately below the mouth of First Anvil Creek to the east boundary line of S27, T5S, R95W.	Aquatic Life Coldwater 1	A	2	FS	
		Recreation N			NA	
		Water Supply			FS	
		Agriculture			FS	
11e	That portion of the mainstem of the East Fork of Parachute Creek, including all tributaries and wetlands, within Sections 27, 28, and 29, T5S, R95W.	Aquatic Life Coldwater 2	B	3	NA	
		Recreation N			NA	
		Water Supply			NA	
		Agriculture			NA	

Table 3.2.9 Stream Classifications and Use Attainment for Stream Segments Located within the Planning Area

WQCC Stream Segment	*Stream Segment Description*	*Classification*	*Numeric Standards List*[1]	*Integrated Report - Use Attainment Category*[2]		*Additional Listing/ Designations*
11f	Mainstem of the East Fork of Parachute Creek from the west boundary line of S29, T5S, R95W to the confluence with Middle Fork of Parachute Creek.	Aquatic Life Coldwater 1	A	1	FS	
		Recreation N			FS	
		Water Supply			FS	
		Agriculture			FS	
11g	All tributaries to East Fork Parachute Creek on the south side of the East Fork Parachute Creek from a point immediately below First Anvil Creek to the confluence with Parachute Creek; all tributaries to Parachute Creek on the east side of Parachute Creek from a point immediately below the East Fork of Parachute Creek to the confluence with the Colorado River; and all tributaries to the Colorado River on the north side of the Colorado River from a point immediately below Cottonwood Creek to the confluence with Parachute Creek except for specific listings in segment 7a.	Aquatic Life Coldwater 2	E	3	NA	
		Recreation N			NA	
		Agriculture			NA	
11h	Mainstem of Parachute Creek, including all tributaries and wetlands, from the confluence of the West and East Forks to the confluence with the Colorado River except for specific listings in segment 11g.	Aquatic Life Coldwater 2	G	1	FS	
		Recreation P			FS	
		Agriculture			FS	
2a	Mainstem of the Colorado River from immediately below the confluence with Rifle Creek to immediately above the confluence of Rapid Creek.	Aquatic Life Warmwater 1	J	2	II	M&E List - sediment
		Recreation E			FS	
		Water Supply			FS	
		Agriculture			FS	
10	Rifle Creek, including all tributaries and wetlands, from Rifle Gap Reservoir to the confluence with the Colorado River. [Includes Government Creek which is a tributary to Rifle Creek]	Aquatic Life Coldwater 1	H	5	NS (Se)	303(d) - selenium (low priority) M&E List - E. Coli
		Recreation E			II	
		Water Supply			FS	
		Agriculture			FS	

Table 3.2.9 Stream Classifications and Use Attainment for Stream Segments Located within the Planning Area

WQCC Stream Segment	*Stream Segment Description*	*Classification*	*Numeric Standards List[1]*	*Integrated Report - Use Attainment Category[2]*		*Additional Listing/ Designations*
4a	All tributaries, including wetlands, to the Colorado River from the confluence with the Roaring Fork River to a point immediately below the confluence with Parachute Creek except for the specific listings in Segments 4b, 4c, 4d, 4e, 5, 6, 7a, 7b, 8, 9a, 9c, 10, 11a - h, and 12a. *[Only includes gulches flowing directly into the Colorado River from the southern portion of the plateau between confluence of Rifle Creek and just below Cottonwood Creek.]*	Aquatic Life Coldwater 2	C	5	NS (Se)	303(d) - selenium (medium priority)
		Recreation N			FS	
		Water Supply			FS	
		Agriculture			FS	
14a (White River Basin)	Mainstem of Piceance Creek from the source to a point just below the confluence with Hunter Creek.	Aquatic Life Coldwater 1	F	2	FS	
		Recreation P			NA	
		Agriculture			FS	
16 (White River Basin)	All tributaries to Piceance Creek, including all wetlands, from the source to the confluence with the White River.	Aquatic Life Warmwater 2	I	3	NA	
		Recreation P			NA	
		Agriculture			NA	

Sources: CDPHE 2012e; 2013.

Notes:
[1] See Table 3.2.10 for standards lists
[2] IR Category 1: attaining water quality standards
IR Category 2: attaining some classified uses
IR Category 3: insufficient data to determine whether or not the classified uses are being attained
IR Category 5: not meeting applicable water quality standards

Key:
FS = Fully Supporting
II = Insufficient Information
IR = Integrated Report
M&E = Colorado's Monitoring & Evaluation List
NA = Not Assessed
NS = Not Supporting (Causes)
OW = outstanding waters (segment met certain criteria pursuant to section 31.8(2)(a) and the presence of CRCT)
Se = Selenium

Table 3.2.10 Water Quality Standards for Stream Segments Located within the Planning Area

		Numeric Standards									
		A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***
Stream Segment		***8, 11a, 11f***	***11e***	***4a***	***11d, 12a***	***11b, 11c, 11g***	***14a (White River)***	***11h***	***10***	***16 (White River)***	***2a***
Classification		***Aq Life Cold 1 Recreation N Water Supply Agriculture***	***Aq Life Cold 2 Recreation N Water Supply Agriculture***		***Aq Life Cold 1 Recreation N Agriculture***	***Aq Life Cold 2 Recreation N Agriculture***	***Aq Life Cold 1 Recreation P Agriculture***	***Aq Life Cold 2 Recreation P Agriculture***	***Aq Life Cold 1 Recreation E Water Supply Agriculture***	***Aq Life Warm 2 Recreation P Agriculture***	***Aq Life Warm 1 Recreation E Water Supply Agriculture***
Physical and Biological											
Temperature (°C)		June-Sept.: maximum weekly average=17.0°C; daily maximum=21.2°C Oct.-May: maximum weekly average=9.0°C; daily maximum=13.0°C	June-Sept.: maximum weekly average=17.0°C; daily maximum=21.2°C Oct.-May: maximum weekly average=9.0°C; daily maximum=13.0°C	April-Oct.: maximum weekly average=18.2°C; daily maximum=23.8°C Nov.-March: maximum weekly average=9.0°C; daily maximum=13.0°C	June-Sept.: maximum weekly average=17.0°C; daily maximum=21.2°C Oct.-May: maximum weekly average=9.0°C; daily maximum=13.0°C	June-Sept.: maximum weekly average=17.0°C; daily maximum=21.2°C Oct.-May: maximum weekly average=9.0°C; daily maximum=13.0°C	June-Sept.: maximum weekly average=17.0°C; daily maximum=21.2°C Oct.-May: maximum weekly average=9.0°C; daily maximum=13.0°C	April-Oct.: maximum weekly average=18.2°C; daily maximum=23.8°C Nov.-March: maximum weekly average=9.0°C; daily maximum=13.0°C	April-Oct.: maximum weekly average=18.2°C; daily maximum=23.8°C Nov.-March: maximum weekly average=9.0°C; daily maximum=13.0°C	March-Nov.: maximum weekly average=28.7°C; daily maximum=31.3°C Dec.-Feb.: maximum weekly average=14.3°C; daily maximum=15.2°C	March-Nov.: maximum weekly average=27.5°C; daily maximum=28.6°C Dec.-Feb.: maximum weekly average=13.7°C; daily maximum=14.3°C
Dissolved Oxygen (mg/L)		6.0								5.0	
Dissolved Oxygen (sp; mg/L)		7.0								-	-
pH		6.5-9.0									
E. Coli per 100mL		630					205		126	205	126
F. Coli per 100 mL		-	-	-	-	2000 (only segment 11b)	-	-	-	-	-
Inorganic (mg/L)											
Residual chlorine	Acute	0.019	-	0.019	0.019	-	0.019	0.019	0.019	0.019	0.019
	Chronic	0.011	-	0.011	0.011	-	0.011	0.011	0.011	0.011	0.011
Sulfide		0.002	0.002	0.002	0.002	-	0.002	0.002	0.002	0.002	0.002
Nitrite as N (nitrogen)		0.05	1	0.05	0.05	10	0.05	0.05	0.05	0.05	0.05
Nitrate as N (nitrogen)		10	10	10	100	100	100	100	10	100	10
Chloride		250	250	250	-	-	-	-	250	250	250
Sulfate		WS	WS	WS	-	-	-	-	WS	-	WS
Metals (µg/L)											
Arsenic	Acute	340	-	340	340	-	340	340	340	340	340
	Chronic	0.02 (Trec)	0.02-10(Trec)	0.02-10(Trec)	7.6 (Trec)	100(Trec)	7.6(Trec)	100(Trec)	0.02(Trec)	100(Trec)	0.02(Trec)
Cadmium	Acute	TVS (tr)	-	TVS	TVS (tr)	-	TVS (tr)	TVS (tr)	TVS(tr)	TVS	TVS
	Chronic	TVS	10(Trec)	TVS	TVS	10(Trec)	TVS	TVS	TVS	TVS	TVS
Copper	Acute	TVS		TVS	TVS		TVS	TVS	TVS	TVS	TVS
	Chronic	TVS	200(Trec)	TVS	TVS	200(Trec)	TVS	TVS	TVS	TVS	TVS
Iron	Chronic	WS (dis) 1000 (Trec)	WS (dis)	WS (dis) 1000 (Trec)	1000(Trec)	-	1000(Trec)	1000(Trec)	WS (dis) 1000 (Trec)	1000(Trec)	WS (dis) 1000 (Trec)
Lead	Acute	TVS		TVS	TVS		TVS	TVS	TVS	TVS	TVS

Table 3.2.10 Water Quality Standards for Stream Segments Located within the Planning Area

		Numeric Standards									
		A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***
Stream Segment		***8, 11a, 11f***	***11e***	***4a***	***11d, 12a***	***11b, 11c, 11g***	***14a (White River)***	***11h***	***10***	***16 (White River)***	***2a***
Classification		***Aq Life Cold 1 Recreation N Water Supply Agriculture***	***Aq Life Cold 2 Recreation N Water Supply Agriculture***		***Aq Life Cold 1 Recreation N Agriculture***	***Aq Life Cold 2 Recreation N Agriculture***	***Aq Life Cold 1 Recreation P Agriculture***	***Aq Life Cold 2 Recreation P Agriculture***	***Aq Life Cold 1 Recreation E Water Supply Agriculture***	***Aq Life Warm 2 Recreation P Agriculture***	***Aq Life Warm 1 Recreation E Water Supply Agriculture***
	Chronic	TVS	100(Trec)	TVS	TVS	100(Trec)	TVS	TVS	TVS	TVS	TVS
Manganese	Acute	TVS		TVS	TVS		TVS	TVS	TVS	TVS	TVS
	Chronic	WS(dis)	WS(dis) 200(Trec)	WS(dis)	TVS	200(Trec)	TVS	TVS	WS(dis)	TVS	WS(dis)
Mercury	Chronic	0.01(tot)	0.01(tot)	0.01(tot)	0.01(tot)	-	0.01(tot)	0.01(tot)	0.01(tot)	0.01(tot)	0.01(tot)
Selenium	Acute	18.4 (dis)		18.4 (dis)	18.4 (dis)TVS)		18.4 (dis)	18.4 (dis)	18.4 (dis)	18.4 (dis)	18.4 (dis)
	Chronic	4.6 (dis)	20(Trec)	4.6 (dis)	4.6 (dis)TVS	20(Trec)	4.6 (dis)	4.6 (dis)	4.6 (dis)	4.6 (dis)	4.6 (dis)
Zinc	Acute	TVS		TVS	TVS		TVS	TVS	TVS	TVS	TVS
	Chronic	TVS	2000(Trec)	TVS	TVS	2000(Trec)	TVS	TVS	TVS	TVS	TVS

Source: CDPHE 2013, updated 2015.

Notes:
WS(dis) = Fe(ch) = Mn(ch): These abbreviations mean: For all surface waters with an actual water supply use, the less restrictive of the following two options shall apply as numerical standards, as specified in the Basic Standards and Methodologies at 31.16 Table II and III:
(i) existing quality as of January 1, 200; or
(ii) Iron 300 µg/L (dissolved)
Manganese 50 µg/L (dissolved)
Sulfate 250 mg/L (dissolved)

For all surface waters with a "water supply" classification that are not in actual use as a water supply, no water supply standards are applied for iron, manganese or sulfate, unless the Commission determines as the result of a site-specific rulemaking hearing that such standards are appropriate.

Key:
µg/L = microgram per liter
ac = acute (1-day)
ch = chronic (30-day)
mg/L = milligrams per liter
mL = milliliter
sp = spawning
tot = total
tr = trout
Trec = total recoverable
TVS = table value standard (found in Regulation 37)
WS-II = warm stream temperature tier two
WS-IV = warm stream temperature tier four

3.2.4.2 Groundwater

Planning Objective

Groundwater in the Planning Area is currently being managed under guidance from several planning documents and other agreements, including the identified planning objectives and criteria for groundwater quality specific to the Roan Plateau. These documents include

1. 1984 GSRA RMP for public lands below the Roan Cliffs:

   - No specific objectives for groundwater.

2. 1997 WRRA RMP:

   - Groundwater quality standards within the WRRA are met using the Conditions of Approval (COAs) in the RMP to prevent degradation by toxins and other impurities from BLM projects and commodity extraction activities that may affect usable subterranean water;

   - Ensure that BLM-administered projects comply with the U.S. Fish and Wildlife Service (USFWS) Programmatic Biological Opinion for minor water depletions in the Upper Colorado River Basin; and

   - Ensure the integrity of aquifer systems in both quantity and quality.

Groundwater standards are regulated pursuant to the Water Quality Control Act, Sections 25-8-202, 25-8-203, and 25-8-204. BLM must comply with Regulation 41, *The Basic Standards for Groundwater*, to protect existing and potential beneficial uses of groundwater (CDPHE 2012b).

As mentioned in Section 3.2.4.1, lands within the Planning Area include portions of the Town of Parachute's DWSPA, as shown in Map 18. The Source Water Protection Plan for the Town of Parachute includes the identification of issues of concern and management approaches and/or BMPs for each (Hill 2013).

In 2008, the COGCC developed and passed new rules that became effective on May 1, 2009, for Federal land and April 1, 2009, on all other land. One of the new rules, Rule 317(b), protects public water systems by protecting the source of their drinking water. The rule creates protection zones, or buffer zones, combined with performance requirements applicable within 5 miles upstream of the surface water intake. The purpose for protecting this zone is that a significant release in these areas would likely contaminate surface water used as a drinking water source. The COGCC also decided that enhanced drilling and production requirements should apply in areas 0.5 mile from the water supply segment in an Intermediate and Extended Buffer Zone (COGCC 2008a).

COGCC also adopted Rule 609, effective May 2013, which makes mandatory baseline and subsequent groundwater monitoring for new oil and gas wells, multi-well sites, and dedicated injection wells (COGCC 2013).

Characteristics and Setting

The hydrologic studies of NOSRs 1 and 3 on behalf of DOE (TRW 1982) indicate that a topographic (surface water) divide between the NOSR streams and the Piceance Creek drainage to the north is also a groundwater divide. The groundwater system underlying NOSRs 1 and 3, for about the first 2,000 feet in depth, is effectively an island having very little interaction with the rest of the Piceance Creek basin.

Furthermore, the hydrogeology on BLM lands within the Planning Area is generally different from that of private lands along the Colorado River and its major tributaries in that the BLM lands tend to have fewer exposures of shallow water-bearing deposits associated with alluvial aquifers. Consequently, few water wells are located on public lands, most being associated with either private lands or portions of the Planning Area closest to the major streams. The Colorado Division of Water Resources (DWR), also known as the State Engineer's Office, issues water well permits and administers water rights. Map 18 displays DWR well applications within a 0.25 mile of the Planning Area perimeter. The wells are grouped into three main categories: (1) constructed well (current status in DWR database lists these wells as constructed); (2) unknown well status (current status of wells is unknown); and (3) abandoned well (current status in DWR database lists these wells as abandoned). Within these three main categories, the wells are differentiated by use: (a) municipal, domestic, household use only; (b) irrigation, stock; (c) other consumptive uses (industrial, commercial, geothermal, recreation); and (d) other (monitoring well, remediation, gravel pit, dewatering).

Lands Atop the Plateau

The groundwater resource underneath the top of the plateau is contained within the Uinta Formation, which crops out along steep valleys and canyons, sideslopes, and the underlying Parachute Creek Member of the Green River Formation. The Roan Plateau is unique compared to most of the Piceance Basin, mainly due to its "perched" bedrock aquifers. These aquifers, known as the Upper and Lower Piceance Basin aquifers, are the principal source of groundwater for the northern province of the Piceance. The upper aquifer includes the sandstone and fractured siltstone of the Uinta Formation and the fractured marlstone and solution cavities of the upper portion of the Parachute Creek Member of the Green River Formation (Figure 3.2-1). The Uinta Formation consists of discontinuous layers of sandstone, siltstone, and marlstone, and is less permeable than the hydrologically connected upper Parachute Creek Member (CGS 2003). The lower aquifer unit includes the fractured marlstone and leached section of the lower part of the Parachute Creek Member. The Mahogany confining unit zone is a leaky semi-confining layer, and the confining properties of the Mahogany zone are not uniform across the study area (USGS 2013-SIR 5132). This confining unit separates the upper and lower aquifer units. The Mahogany zone is located in the upper one-third of the Parachute Creek Member (CGS 2003).

Fractures are ubiquitous in both the upper and lower aquifers, leading to relatively high conductivity rates (less than 0.1 to greater than 1.6 feet per day). These fractures increase the propagation of fluids throughout both aquifer systems, including movement through the semi-permeable Mahogany confining zone. The majority of these fluids are discharged at numerous springs, seeps, and creeks (Figures 3.2-1 and 3.2-2) (CGS 2003).

Recharge of the aquifer system occurs primarily through a combination of snowmelt and loss from streams; the natural recharge area for the Piceance Basin is shown in Figure 3.2-2. Summer rainfall does not appear to be a major contributor to recharge, except to the extent that it contributes to streamflow. TRW (1982) described instantaneous streamflow data collected by USGS at 63 locations in the East Fork Parachute Creek, Ben Good Creek, and East Middle Fork Parachute Creek/Trapper Creek drainages. These measurements revealed several losing reaches corresponding to outcrops of bedrock associated with the lower aquifer unit.

Era	System	Series	Stratigraphic Unit	Unit Thickness	Physical Description	Hydrogeologic Unit	Hydrological Characteristics
Cenozoic	Tertiary	Eocene	Uintah Formation	0-1,400	Silty sandstone, Siltsone and marlstone	Upper Piceance Basin aquifer	Conductivity range <0.2 to >1.6 ft/day; yield 1 to 900 gpm: transmissivity 610-700ft^2/day
			Green River Formation	As much as 5,000	*Parachute Creek Member* kergenous, dolomitic marlstone and shale 500-1,800 ft	Mahogany confining unit	
					Anvil Points Member shale, fine-grained sandstone and marlstone0-1,870 ft.	Lower Piceance Basin aquifer	Conductivity range <0.1 to >1.2 ft/day; yield 1 to 1,000 gpm; transmissivity 260-380ft2/day
					Garden Gulch Member claystone, siltstone, clay-rich oil shale and marlstone 0-900 ft.	Confining unit	
					Douglas Creek Member siltstone, shale and channel sandstone 0-900 ft.		
			Wasatch Formation	~5,000	Shale and lenticular sandstone		
		Paleocene	Fort Union Formation	Very Thin	Coarse-grained sandstone	Fort Union aquifer	
Mesozoic	Cretaceous	Upper Cretaceous	Mesaverde Group	Averages 3,000 may be >7,000	*Fox-Hills Sandstone, Lewis Shale, Williams Fork Formation, Iles Formation;* sandstone interbed shale and coal	Mesaverde aquifer	
			Mancos Shale	More than 7,000	Mainly Shale but Frontier Sandstone may be local aquifer	Mancos confining unit	

Figure 3.2-1 Hydrogeologic Units of the Piceance Basin (CGS 2003)

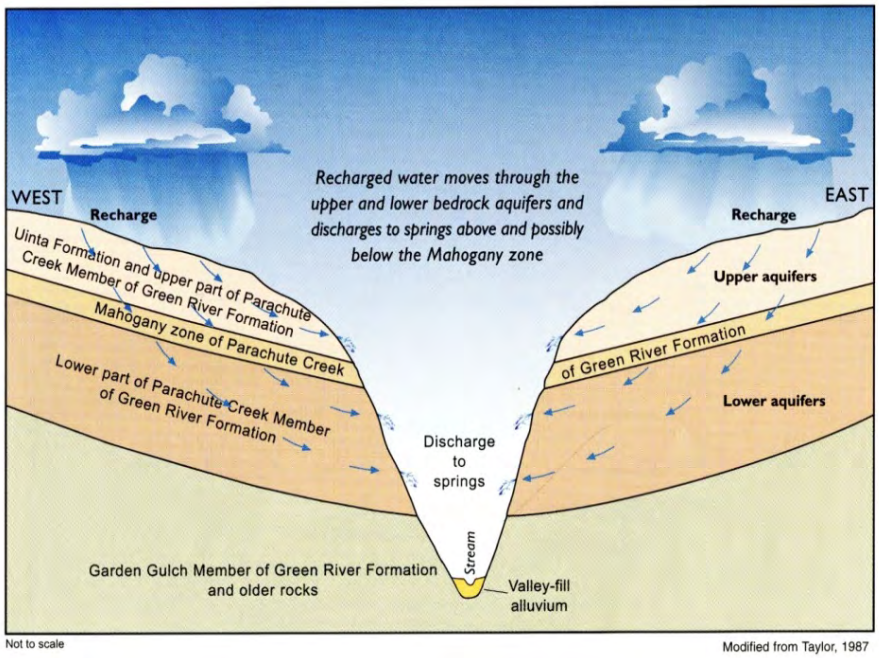


Figure 3.2-2 Diagrammatic Cross-Section of Groundwater Movement in Roan and Parachute Creek Drainage Basins

According to DWR well application data, there are 26 constructed wells atop the plateau (2 municipal/domestic/household use only wells, 1 irrigation/stock wells, and 23 other wells) (Map 18). There are two water sources that are known to be used for drinking water within the Planning Area: Roan Cliffs Well (241417, decreed for domestic use) and Horse Pasture Spring (01CW0094, decreed for livestock and wildlife use). Both of these water sources are atop the plateau. Below the rim there are 58 municipal/domestic/household use only wells that are not included in the municipal water systems.

Water in the Tertiary aquifer system for the northern portion of the Piceance Basin gains dissolved solids and shows changes in major ion chemistry as it moves along the basin flow paths from the upland recharge areas to the discharge areas. In the upper aquifer unit, the dissolved solids concentration increases from 500 to 1,000 mg/L. The chemical water classification is diverse, ranging from calcium carbonate to sodium carbonate water with large concentrations of sulfate. In the lower aquifer unit, the dissolved solids concentration increases from about 1,000 to 10,000 mg/L along the basin flow paths. Waters with dissolved solids concentrations in excess of 1,000 mg/L are generally unsuitable for potable supply. Water in the lower aquifer unit is characterized as a sodium-carbonate type. Processes in the recharge areas contributing to water quality include dissolution of calcite and dolomite. Chemical reactions in the down-gradient areas likely include dissolution of nahcolite and halite (CGS 2003). Of the parameters measured beneath NOSR 1 (TRW 1982), several parameters exceeded Domestic Water Supply Standards: dissolved iron (5.8 mg/L; drinking water standard=0.3 mg/L) and dissolved fluoride (1.6 mg/L; human health standard=4.0 mg/L) in the upper aquifer unit, and fluoride (7.0 mg/L) in the lower aquifer unit. The MCL for fluoride is 4 mg/L and the secondary standard is 2 mg/L. Major ion concentrations in groundwater investigated by TRW (1982) are summarized in Table 3.2.11, provided at the conclusion of Section 3.2.4.2.

Atop the plateau, groundwater is discharged from the upper aquifer unit and possibly lower unit (see comments above on leaky Mahogany Zone) at numerous springs and seeps, which contribute to base flows in the East Fork Parachute Creek and East Middle Fork Parachute Creek basins. Springs identified by BLM and the springs with associated DWR water rights in the vicinity of the Planning Area are shown on Map 18. Results of a detailed reconnaissance of 90 springs in NOSR 1 (TRW 1982) yielded a range of specific conductivities of 340 to 695 µmhos/cm at 25°C (mean = 516). TRW (1982) described the quality of spring water on NOSR 1 as being rather uniform calcium-bicarbonate waters or mixed-cation-bicarbonate waters with calcium dominant. Major ion concentrations for selected springs are presented in Table 3.2.12, provided at the conclusion of Section 3.2.4.2. Concentrations of trace elements were extremely low, and all samples met U.S. Environmental Protection Agency (EPA) drinking water standards, with a low sodium and medium salinity hazard. TRW (1982) also inferred that the spring water had moved predominantly through the upper aquifer unit and had a relatively short residence time in the aquifer. It was noted that the "high concentration of carbonate species helps explain the travertine-like deposits often found near springs on NOSR 1."

Water quality was sampled at Horse Pasture Spring in July 2012 for several drinking water parameters and no exceedances were noted (Adams 2015).

Lands Below the Rim

The surficial geology of NOSR 3 (along and below the cliffs) consists of the lower part of the Green River Formation (below the Parachute Creek Member) and underlying Wasatch Formation. These formations are not known to contain significant usable water-bearing zones. A slight potential exists for minor aquifers in the lenticular sandstones of the Wasatch Formation. Hydrologic information from the Garfield County landfill studies indicates that no usable aquifers exist within the landfill area. Studies have shown that the Williams Fork Formation, part of the Mesaverde Group, is a semi-confined aquifer under artesian pressure specifically in the Garfield County area, where upwelling can occur along conduits, such as well bores or natural fractures; this mechanism can allow deep groundwater to migrate into shallow aquifers (Thomas and McMahon 2013).

Nearly all of the wells below the cliffs are located on private land. According to DWR well application data, there are 254 constructed wells below the plateau (58 municipal/domestic/household use only wells, 12 irrigation/stock wells, and 184 other wells) (Map 18). Many of these wells are less than 100 feet deep and generally intersect the alluvial aquifers along the Colorado River, Parachute Creek, and other lower elevation streams and tributaries throughout the area. The deeper wells range in depth from about 100 to 250 feet, with a few in excess of 400 feet. These wells are mostly located on the slopes and benches south of the Colorado River and south of the Planning Area.

As discussed in Section 3.2.4.1, the hydrocarbon release associated with Williams Company gas-processing plant in 2013 contaminated groundwater downgradient from the original spill within the alluvial valley encompassing Parachute Creek. Groundwater has been monitored at numerous temporary and permanent monitor wells distributed throughout the impacted area. Benzene concentrations have been detected as high as 38,000 µg/L near the recovery trench in the vicinity of the spill location (S.S. Papadopulos & Associates 2013). Remedial action is ongoing, and details can be found in the Corrective Measures Work Plan (Shaw Environmental, Inc. 2014). Since initiation of remedial actions and through February 2014, approximately 240 barrels of liquid hydrocarbon have been removed from the subsurface and approximately 1,500 cubic yards of contaminated soil.

Table 3.2.11 Concentration Ranges of Major Ions in Groundwater Samples from Roan Plateau Planning Area[1]

Well No.	*Area*	*Calcium (mg/L)*	*Magnesium (mg/L)*	*Sodium (mg/L)*	*Potassium (mg/L)*	*Bicarbonate (mg/L)*	*Chloride (mg/L)*	*Sulfate (mg/L)*	*Total Dissolved Solids (mg/L)*	*Specific Conductance (µS/cm)*
Drinking Water Standards							250	250	500	
15/16	NW	4.9 – 18	5.6 – 9.8	70 – 410	4.0 – 20	223 – 910	3.5 – 106	20 – 240	272 – 1,060	480 – 1,820
17	NC	9.8 – 35	12 – 23	45 – 130	3.0 – 4.7	248 – 414	4.9 – 9.1	<4.0 – 25	296 – 415	556 – 682
18	NW	51 – 67	17 – 26	63 – 65	0.1 – 1.5	345 – 395	8.5 – 13	32 – 64	345 – 430	550 – 650
19	NE	insufficient aquifer (zones dry)								
20	WC	15 – 82	5.8 – 19	132 – 155	1.3 – 8.4	438 – 500	<3.0 – 12	22 – 145	490 – 587	785 – 1,030
21	C	21 – 49	3.7 – 20	30 – 85	<0.1 – 3.0	248 – 362	<3.0 – 6.5	17 – 68	290 – 430	495 – 855
22	C	23 – 26	13 – 15	55 – 125	<1.0 – 3.7	255 – 435	9.1 – 9.2	22 – 50	302 – 450	<0.2 – 460
24	SC	71 (2)	16 – 25	21 – 55	4.0 (2)	357 – 382	<3.0 – 12	22 – 48	371 – 420	660 – 671
25	SE	insufficient aquifer (zones dry)								
26	SW	23 – 33	4.4 – 16	70 – 125	3.0 – 6.2	280 – 414	5.6 – 13	<4.0 – 59	340 – 400	649 – 670

Sources: TRW 1982; CDPHE 2013, updated 2015.

Note:
[1] Compilation of water quality data for samples of from upper and lower aquifer units; some zones not present in some wells.

Table 3.2.12 Major Ion Concentrations in Spring Samples from Roan Plateau Planning Area1

Site No.	*Area*	*Calcium (mg/L)*	*Magnesium (mg/L)*	*Sodium (mg/L)*	*Potassium (mg/L)*	*Bicarbonate (mg/L)*	*Chloride (mg/L)* [2]	*Sulfate (mg/L)* [2]	*Total Dissolved Solids (mg/L)*	*Specific Conductance (µS/cm)* [3]
2	NE	61	19	41	<1.0	310	6.4	53	340	520
26	C	72	24	48	<1.0	390	11	49	400	665
33	E	66	15	37	<1.0	295	11	48	330	480
43	W	46	17	31	2.4	245	12	37	315	450
46	NW	54	20	25	2.6	245	23	39	280	490
53	SE	66	16	30	<1.0	310	5.6	33	330	505
78	SW	59	19	47	2.5	300	7.1	62	350	540
84	NE	62	20	39	2.8	335	11	25	340	520
87	NC	54	19	44	2.7	310	20	29	320	520

Sources: TRW 1982; CDPHE 2013, updated 2015.

Notes:
[1] One-time samples (1981) from selected nine springs.
[2] Surface water quality standard is 250 mg/L.
[3] Specific conductivity for 90 springs sampled: range = 340 – 695 µS/cm at 25°C; mean = 516 µS/cm at 25°C (TRW 1982).

3.2.4.3 Water Yield

Planning Objective

Water yield in the Planning Area is currently being managed under guidance from several planning documents. Other agreements identify planning objectives and criteria for water rights and yields specific to the Roan Plateau. These include:

1. 1984 GSRA RMP:

    - Increase water yield throughout the resource area through forest management practices and through treatment of mountain brush vegetation types to improve livestock and big game forage.

2. 1997 WRRA RMP:

    - No specific objectives for water yield.

Characteristics and Setting

Areas on top of the plateau consist of forested or other areas of relatively dense vegetation cover. Many of these areas are fairly steep and characterized by shallow bedrock. Snowpack is variable, but typical winter accumulations are sufficient to sustain a marked snowmelt season in spring. Springs are abundant atop the plateau, supplementing the yield from snowmelt and precipitation runoff. Few wells have been developed on public lands atop the plateau, and the resource remains little utilized.

Below the rim, the lower elevations, generally southern exposures, and comparatively sparse vegetation result in little or no accumulated snowpack in most years. This drier regime is also reflected by fewer springs. Opportunities for enhanced yield through vegetation management are, therefore, limited.

Little or no use of groundwater is occurring on public lands, except for some at the undeveloped springs used by livestock and wildlife and a few springs developed for livestock watering. There are actually many developed springs, and hundreds of undeveloped springs, in addition to two drinking water locations.

Factors Affecting Water Yield

Water yield is dependent on both natural factors and land management. Natural factors include climate, geology and soils, slope, channel conditions, and vegetation type and density. Management of lands in such a way that affects these natural factors plays a role in altering water yield.

3.2.4.4 Water Rights

Planning Objective

Water rights in the Planning Area are currently being managed under several planning documents and other agreements that identify planning objectives and criteria for water rights specific to the Roan Plateau:

1. 1984 GSRA RMP:

    - No specific objectives for water rights.

2. 1997 WRRA RMP:

- No specific objectives for water rights.

Characteristics and Setting

For many of the more than nearly 300 springs or seeps identified within the Planning Area (Map 18), the BLM has filed for and secured water rights from the State of Colorado for listed uses, including wildlife watering, wildlife habitat, livestock watering, and recreation. Mapping of locations, measurement of flow, and collection of water quality data including pH, specific conductance, and temperature have been completed.

The BLM has completed instream flow assessments for all perennial streams within the Planning Area that are capable of supporting a fishery. These creeks include JQS Gulch, First Anvil Creek, Second Anvil Creek, East Fork Parachute Creek, East Middle Fork Parachute Creek, Northwater Creek, and Trapper Creek (Map 17). These assessments document type and size of fish populations, types of macroinvertebrate communities, water quality parameters, channel morphology, and flow rates necessary to provide fish habitat. Using the results from the instream flow surveys, the BLM recommended that the Colorado Water Conservation Board (CWCB) appropriate instream flow water rights on each of the creeks above and provided recommended flow amounts. The CWCB secured instream flow water rights pursuant to these recommendations in 2000 (Table 3.2.13).

Table 3.2.13 Colorado Water Conservation Board Instream Flow Water Rights

Case Number	*Stream Name*	*Segment Length (miles)*	*Upper Terminus*	*Lower Terminus*
Appropriated	East Fork Parachute Creek	1.28	Confluence with Bull Gulch	BLM Boundary
5-00CW133	East Fork Parachute Creek	2.1	Confluence with First Anvil Creek	Confluence with Bull Gulch
5-00CW134	East Fork Parachute Creek	1.9	Confluence with Second Anvil Creek	Confluence with First Anvil Creek
5-00CW135	East Fork Parachute Creek	2.2	Confluence of JQS & Golden Castle Gulches	Confluence with Second Anvil Creek
5-00CW129	East Middle Fork Parachute Creek	1.7	Confluence of Northwater and Trapper Creeks	Confluence with Corral Gulch
5-00CW131	First Anvil Creek	2.3	Headwaters	Confluence with East Fork Parachute Creek
5-00CW128	JQS Gulch	1.1	Confluence with unnamed tributary	Confluence with Golden Castle Gulch
5-00CW130	Northwater Creek	2.7	Confluence with Raspberry Creek	Confluence with Trappers Creek
5-85CW635	Northwater Creek	6.1	Headwaters	Confluence with Trappers Creek
5-00CW132	Second Anvil Creek	2	Headwaters	Confluence with East Fork Parachute Creek
5-85CW634	Trapper Creek	5.3	Headwaters	Confluence with Northwater Creek

Factors Affecting Water Rights

The use of water in Colorado is governed by what is known as the prior appropriation system. This system of water allocation controls who uses how much water, the types of uses allowed, and when those waters can be used. Simplified, the first to appropriate water and apply that water to use has the first right to that water within a particular stream system (DWR 2002).

3.2.5 Climate and Air Quality

Information describing the Affected Environment for climate and air quality has been updated since completion of the Roan FEIS to provide detail appropriate to the Colorado Air Resources Management Modeling Study (CARMMS).

3.2.5.1 Introduction

This section describes the existing conditions and regulatory setting associated with the development of oil and gas leases in the Roan Plateau with respect to air quality.

3.2.5.2 Regulatory Setting

Ambient air quality and air pollutant emissions from stationary and mobile sources are managed under a framework of Federal and State rules and regulations.

Federal Clean Air Act

The Clean Air Act (CAA; U.S Code Title 42, Chapter 85) is the law that defines the EPA responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The last major change in the law, the CAA Amendments of 1990, was enacted by Congress in 1990. Legislation passed since then has resulted in several minor changes. Under the CAA, the EPA oversees implementation of Federal programs for permitting new and modified stationary sources, controlling toxic air contaminants, and reducing emissions from motor vehicles and other mobile sources.

The EPA, as directed by the CAA, has established national ambient air quality standards (NAAQS) for criteria pollutants. Criteria pollutants are air contaminants that are commonly emitted from the majority of emissions sources and include carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2), particulate matter less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$, respectively), ozone (O_3), and nitrogen dioxide (NO_2). Note that ozone is generally not directly emitted from a source but is chemically formed in the atmosphere via interactions of oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) in the presence of sunlight and under certain meteorological conditions. (NO_X and VOCs are ozone precursors.) Two types of NAAQS have been established, primary and secondary. Primary standards are designed to protect public health, while secondary standards are designed to protect public welfare, which includes protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The current NAAQS levels are shown in Table 3.2.14 below.

Table 3.2.14 Ambient Air Quality Standards

Pollutant	*Averaging Time*	*NAAQS*		*Form*
		Primary	*Secondary*	
CO [76 FR 54294, Aug 31, 2011]	8-hour	9 ppm	–	Not to be exceeded more than once per year
	1-hour	35 ppm	–	
Lead [73 FR 66964, Nov 12, 2008]	3-month (rolling average)	0.15 µg/m^3	0.15 µg/m^3(1)	Not to be exceeded
NO_2 [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]	Annual	0.053 ppm	0.053 ppm(2)	Annual Mean
	1-hour	0.100 ppm(2)	–	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Ozone [73 FR 16436, Mar 27, 2008]	8-hour	0.075 ppm(3)	0.075 ppm(3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
PM_{10} [73 FR 3086, Jan 15, 2013]	24-hour	150 µg/m^3	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
$PM_{2.5}$ [73 FR 3086, Jan 15, 2013]	Annual	12.0 µg/m^3	15.0 µg/m^3	Annual mean, averaged over 3 years
	24-hour	35 µg/m^3	35 µg/m^3	98th percentile, averaged over 3 years
SO_2 (5) [38 FR 25678, Sept 14, 1973] [75 FR 35520, Jun 22, 2010]	3-hour	–	0.5 ppm	Not to be exceeded more than once per year
	1-hour	0.075 ppm(4)	–	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Colorado (State Only)	3-hour	–	267 ppb	Not to be exceeded in any 12 month period

Sources: EPA 2014; CDPHE 2013, updated 2015.

Notes:
(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
(2) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
(3) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.
(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.
(5) Colorado has adopted its own SO_2 secondary standard. The 3-hour average concentration cannot exceed 700 µg/m^3 (or 0.267 ppm) more than once per year.

Key:
µg/m^3 = micrograms per cubic meter
CO = carbon monoxide
NAAQS = National Ambient Air Quality Standards
NO_2 = Nitrogen dioxide
PM_{10} = particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter
ppb = parts per billion
ppm = parts per million

Prevention of Significant Deterioration

The CAA contains provisions for protection of air quality in areas that are meeting the ambient air quality standards. This is known as the prevention of significant deterioration (PSD) program. Under this program, areas of the country are designated as Class I or Class II. Class I areas are defined as areas of

special, national, or regional natural, recreational, or historic value and thus receive special protection under the CAA. Class I areas include wilderness areas more than 5,000 acres in size and national parks more than 6,000 acres in size that were in existence in 1977. Sensitive Class II areas are usually afforded additional protection under State-specific rule making for one or more pollutants. This status distinguishes them from Class II areas, which account for every other area of the country that is not explicitly designated as Class I or Sensitive Class II.

An area's class designation determines the maximum amount of additional air pollution, called an increment, which can be added beyond a baseline value emitted from new or modified "major" stationary sources of pollution. Increment consumption analysis falls under the PSD major sources permitting program, which is administered in Colorado by the Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division (APCD). Only small amounts of pollutants can be added in Class I areas, while Class II areas permit moderate amounts of pollutants to be added. Class I areas within 120 miles of the Planning Area are shown in Table 3.2.15 below.

Table 3.2.15 PSD Class I Areas Near the Roan Plateau Planning Area

Mandatory Federal Class I Areas	*Managing Agency*	*Class Category*	*State*	*Distance and Direction*
Black Canyon of the Gunnison National Park	NPS	Class I	Colorado	25 mi SSE
Eagles Nest Wilderness Area	USFS	Class I	Colorado	65 mi E
Flat Tops Wilderness Area	USFS	Class I	Colorado	30 mi ENE
La Garita Wilderness Area	USFS	Class I	Colorado	80 mi SSE
Maroon Bells-Snowmass Wilderness Area	USFS	Class I	Colorado	25 mi SSE
Mount Zirkel Wilderness Area	USFS	Class I	Colorado	90 mi NE
Rawah Wilderness Area	USFS	Class I	Colorado	120 mi NE
Weminuche Wilderness Area	USFS	Class I	Colorado	100 mi SSE
West Elk Wilderness Area	USFS	Class I	Colorado	35 mi SE

Key:
NPS = National Park Service

The CAA also charges Federal land managers with an "affirmative responsibility to protect the air quality related values (including visibility)" of Class I areas that they manage. Air quality related values are resources, as identified by the Federal land manager (FLM), for one or more Federal areas that may be adversely affected by a change in air quality. The resources may include visibility or specific scenic, cultural, physical, biological, ecological, or recreational resources identified by the FLM for a particular area (FLAG 2010).

Visibility

Visibility is a measure of not only how far one can see but how well one can see important characteristics of the landscape such as form, color, geologic features, and texture. Visibility impairment is caused by the scattering of light by gases and particles in the atmosphere. Some particles in the atmosphere result from man-made pollution, resulting in haze. A monitoring network was established by the Interagency Monitoring of Protected Visual Environments (IMPROVE) program to measure atmospheric particulate concentrations near Class I areas.

The CAA amendments of 1977 set a national goal of preventing future impairment of visibility and remedying any existing impairment of visibility in Class I areas that is caused by man-made pollution. The EPA promulgated the Regional Haze Rule in order to meet this goal. The Regional Haze Rule

requires states to develop air quality protection plans to reduce the pollution that causes visibility impairment in Class I areas, with a goal of achieving "natural" visibility levels within a 60-year period. The EPA has provided guidance to help states estimate natural visibility for their Class I areas (EPA 2003).

Hazardous Air Pollutants

Air pollutants that may cause chronic (long-term) or acute (short-term) harmful effects are classified as hazardous air pollutants (HAPs). CAA Sections 111 and 112 establish mechanisms for controlling HAPs from stationary sources, and the EPA is required to control emissions of 187 HAPs. Unlike criteria pollutants, the CAA does not establish ambient concentration standards for HAPs. However, the EPA has promulgated National Emission Standards for Hazardous Air Pollutants (NESHAP) for 96 different source categories. While NESHAP applicability will depend on the type of source constructed, the following NESHAP regulations are likely to apply to facilities constructed in the Planning Area:

- NESHAP Subpart HH, National Emission Standard for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities; and
- NESHAP Subpart ZZZZ, National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

A list of NESHAP regulations can be found on the EPA's web site: (http://www.epa.gov/ttn/atw/mactfnlalph.html).

New Source Performance Standards (NSPS)

CAA section 111 establishes mechanisms for controlling emissions of air pollutants from stationary sources. Section 111(b) provides authority for the EPA to promulgate NSPS that apply only to new and modified sources. These standards are intended to promote use of the best air pollution control technologies, taking into account the cost of such technology and any other non-air quality, health, and environmental impact and energy requirements. The EPA has promulgated NSPS for 94 different source categories. While NSPS applicability will depend on the type of source constructed, the following NSPS are likely to apply to facilities constructed in the Planning Area:

- NSPS Subpart JJJJ, Standards of Performance for Stationary Spark Ignition Internal Combustion Engines; and
- NSPS Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution.

Non-Road Diesel Engine Standards

EPA established Federal standards for new non-road diesel engines that would include most oil and gas development drilling, completion, and hydraulic fracturing engines. The 1998 non-road engine regulations were structured as a 3-tiered progression. Each tier involved a phase-in (by horsepower rating) over several years. Tier 1 standards were phased-in from 1996 to 2000. The more stringent Tier 2 standards took effect from 2001 to 2006, and yet more stringent Tier 3 standards phased-in from 2006 to 2008. The Tier 4 emission standards—phased-in from 2008 through 2015—introduce substantial reductions of NO_x (for engines above 56 kW) and PM (above 19 kW), as well as more stringent HC limits. For Tier 4 emissions standards, CO emission limits remain unchanged from the Tier 2-3 stage.

State Regulations

The EPA has delegated to the State of Colorado the authority to enforce NAAQS and PSD increments and to issue air quality permits. The CAA requires states to submit State Implementation Plans (SIPs) to the EPA that provide for the implementation, attainment, maintenance, and enforcement of the NAAQS. The CDPHE, APCD administers Colorado's air quality control programs and is responsible for enforcing the State's air pollution laws.

The Colorado Air Pollution Control Commission oversees the development and adoption of the State's air quality regulation program. The commission can set its own ambient air quality standards that are equal to or more stringent than the Federal air quality standards. The State has adopted one additional standard (for SO_2) in addition to the Federal standards, which is noted in Table 3.2.14. The APCD implements the air management programs adopted by the commission and enforces compliance with the NAAQS and PSD increments.

In February 2014, the State of Colorado adopted new regulations that will affect emissions from the oil and gas industry. These include Regulation 7, which contains extensive requirements to control emissions of ozone precursors and hydrocarbons from equipment associated with oil and gas development and production. In addition to extensive VOC reductions, Regulation 7 revisions also regulate methane emissions from the oil and gas industry. Colorado also adopted Regulation 6, which incorporates NSPS Subpart OOOO.

Other regulations potentially affecting oil and gas projects include Regulation 8, in which Colorado adopts Federal air quality regulations for control of hazardous air pollutants. Reporting of HAPs is required under Regulation 3 if uncontrolled emissions are more than 250 pounds per year.

3.2.5.3 Existing Regional Air Quality

Air quality for any area is generally influenced by the amount of pollutants that are released within the area and upwind of that area. Air quality for any area is also highly dependent upon each contaminant's chemical and physical properties. Additionally, an area's topography or terrain (such as mountains and valleys) and weather (such as wind, temperature, air turbulence, air pressure, rainfall, and cloud cover) will have a direct bearing on how pollutants accumulate or disperse.

Ambient air quality in the affected environment (i.e., including compliance with the NAAQS shown in Table 3.2.14) is measured by monitoring for ground-level atmospheric air pollutant concentrations. The APCD monitors ambient air quality at a number of locations throughout the State. The data is summarized by monitoring regions and CDPHE prepares an annual report (Annual Air Quality Reports) to inform the public about air quality trends within these regions. Similarly, several FLMs such as the BLM, United States Forest Service (USFS), and the National Park Service (NPS) also monitor air quality for NAAQS and Air Quality Related Values (AQRVs). Table 3.2.16 below presents four years of monitoring data for criteria pollutants in Garfield County, where the Planning Area is located, and in adjacent counties in northwest Colorado.

The Planning Area is currently designated as in attainment of the NAAQS for all criteria pollutants. Two monitors, one in Rio Blanco County (Rangely) and one in Garfield County (Sunlight Mountain) have recorded ozone above the concentration value of the NAAQS. These values by themselves do not necessarily mean that the area will be designated as nonattainment (which would be determined by CDPHE and EPA). The form of the ozone NAAQS (the three-year average) must be considered along with the monitored values. Figure 3.2-3 below shows ambient air quality monitor locations in relation to the Planning Area.

The individual yearly ambient monitoring data shown in Table 3.2.16 provides information about existing air quality in the Planning Area and region. However, to evaluate the impact on ambient concentrations from potential future oil and gas development scenarios, refined existing (i.e., baseline) condition data in the same format as the individual NAAQS are required for future projected air quality modeling analyses.

Table 3.2.16 Ambient Air Quality Monitoring Data 2011 – 2014, Northwest Colorado

County	City/Site	Pollutant	Averaging Time	Monitored Values			
				2011	2012	2013	2014
Garfield	Rifle	O_3	8-hour[1]	0.066 ppm	0.068 ppm	0.062 ppm	0.061 ppm
		PM_{10}	24-hour[2]	53 μg/m^3	46 μg/m^3	34 μg/m^3	42 μg/m^3
	Flattops #3	O_3	8-hour[1]	0.055 ppm	0.068 ppm	0.067 ppm	N/A
	Ripple Creek Pass	O_3	8-hour[1]	0.058 ppm	0.068 ppm	0.067 ppm	N/A
	Sunlight Mountain	O_3	8-hour[1]	0.076 ppm	0.082 ppm	N/A	N/A
	Wilson	O_3	8-hour[1]	0.074 ppm	0.071 ppm	0.066 ppm	N/A
	Parachute	PM_{10}	24-hour[2]	73 μg/m^3	44 μg/m^3	28 μg/m^3	38 μg/m^3
	Carbondale	PM_{10}	24-hour[2]	N/A	38 μg/m^3	33 μg/m^3	39 μg/m^3
Mesa	Grand Junction	CO	1-hour[5]	1.8 ppm	1.6 ppm	1.4 ppm	1.7 ppm
		CO	8-hour[5]	1.1 ppm	1.0 ppm	0.9 ppm	0.9 ppm
		PM_{10}	24-hour[2]	45 μg/m^3	143 μg/m^3	56 μg/m^3	45 μg/m^3
		$PM_{2.5}$	24-hour (98th Percentile)[3]	22 μg/m^3	24 μg/m^3	40 μg/m^3	21 μg/m^3
		$PM_{2.5}$	Annual[3]	7.1 μg/m^3	7.3 μg/m^3	8.8 μg/m^3	7.4 μg/m^3
	Palisade	O_3	8-hour[1]	0.066 ppm	0.071 ppm	0.066 ppm	0.062 ppm
	Grand Mesa	O_3	8-hour[1]	0.062 ppm	0.070 ppm	0.060 ppm	N/A
	Silt-Colbran	O_3	8-hour[1]	0.074 ppm	0.073 ppm	0.065 ppm	N/A
	Colorado National Monument	O_3	8-hour[1]	0.068 ppm	0.071 ppm	N/A	N/A
	Clifton	PM_{10}	24-hour[2]	54 μg/m^3	64 μg/m^3	53 μg/m^3	45 μg/m^3
Moffat	17820 County Road 17	O_3	8-hour[1]	0.060 ppm	0.066 ppm	0.065 ppm	0.062 ppm
Pitkin	Aspen	PM_{10}	24-hour[2]	46 μg/m^3	55 μg/m^3	35 μg/m^3	37 μg/m^3
		O_3	8-hour[1]	0.064 ppm	0.050 ppm	N/A	N/A

Table 3.2.16 Ambient Air Quality Monitoring Data 2011 – 2014, Northwest Colorado

County	City/Site	Pollutant	Averaging Time	Monitored Values			
				2011	2012	2013	2014
Rio Blanco	Meeker, Colorado Plant Science Building	NO_2	1-hour (98th Percentile)[4]	5 ppb	5 ppb	4 ppb	4 ppb
		O_3	8-hour[1]	0.063 ppm	0.064 ppm	0.064 ppm	0.062 ppm
	Rangely Colorado, Golf Course	NO_2	1-hour (98th Percentile)[4]	23 ppb	19 ppb	24 ppb	14 ppb
		O_3	8-hour[1]	0.073 ppm	0.069 ppm	0.091 ppm	0.062 ppm
Routt	Steamboat Springs	PM_{10}	24-hour[2]	79 $\mu g/m^3$	93 $\mu g/m^3$	77 $\mu g/m^3$	81 $\mu g/m^3$

Source: EPA 2015b.

Notes:
(1) Ozone 8-hour average is the annual fourth-highest daily maximum 8-hour average concentration. For comparison with NAAQS standard average over three years. 4th high values shown in table.
(2) For comparison with NAAQS,24-hour average PM_{10} concentration not to be exceeded more than once per year on average over three years. 2nd high values shown in table.
(3) For comparison with NAAQS, 24-hour and annual average $PM_{2.5}$ concentrations are averaged over three years. 98th percentile values shown in table for 24-hour average.
(4) For comparison with NAAQS, 1-hour NO_2 concentrations are averaged over three years. 98th percentile values shown in table.
(5) For comparison to the NAAQS, 1-hour and 8-hour average CO concentrations are not to be exceeded more than once per year. 2nd high values shown in table.

Key:
$\mu g/m^3$ = micrograms per cubic meter
CO = carbon monoxide
N/A = monitor value not readily available
NO_2 = nitrogen dioxide
O_3 = ozone
PM_{10} = particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter
ppm = parts per million

For refined base case data for the Colorado Air Resource Management Modeling Study (CARMMS), two additional base-case data sets were developed (BLM 2015b) using regional monitoring data. Ozone monitoring data were used to develop design value concentrations (DVCs) for 8-hour ozone for the years 2006 to 2010 period centered on year 2008. Design values for three 3-year periods (2006 to 2008, 2007 to 2009, and 2008 to 2010) were determined, then averaged to calculate the 2008 base-case design values for ozone. These design values are the base case ozone concentration values used for CARMMS and determining future year modeled concentration NAAQS compliance. To develop a design future value (DFV), the current ozone design value (2008) is scaled using the changes in the CARMMS modeled results from base year 2008 to the future year 2021. This scaling value is known as a relative response factor (RRF). Once the future ozone design value is calculated, it is used to assess future ozone NAAQS compliance by comparing the future design value with the NAAQS shown in Section 3.2.4.

The CARMMS utilized year 2008 emissions and modeling output from the West-wide Jump Start Air Quality Modeling Study (WestJumpAQMS) year 2008 base-case modeling platform (WRAP 2013). The WestJumpAQMS modeled year 2008 one-hour NO_2, eight-hour ozone, and $PM_{2.5}$ (annual and 24-hour) average concentrations in the regional assessment are based on national-scale year 2008 emission inventories for all emissions categories with refinement in regional emissions categories including oil and gas. These year 2008 cumulative modeled impacts serve as the base case to compare with CARMMS

modeling for the projected future year 2021 analysis. The comparison of the 2008 WestJumpAQMS/ CARMMS-modeled base case results to future year CARMMS modeling results describes the overall modeled cumulative changes in air quality in the region. The modeled base case 2008 ozone design value concentration plot is shown in Figure 3.2-4. Ozone design values for Colorado monitoring stations centered on year 2008 used to estimate DVFs at Colorado monitors for CARMMS are shown in Table 3.2.17. WestJumpAQMS-modeled 2008 base-case concentrations for other pollutants and averaging times that are used for CARMMS are shown in Figures 3.2-5 through 3.2-8.

The WestJumpAQMS/CARMMS base-case 2008 model results are not directly comparable to the monitored values shown in Table 3.2.16 because the monitoring results are for different years. Similarly, the ozone design values shown in Table 3.2.17 are not directly comparable to the ozone concentrations shown in Table 3.2.16 because the tables represent different monitor locations, years of monitoring, and averaging methods.

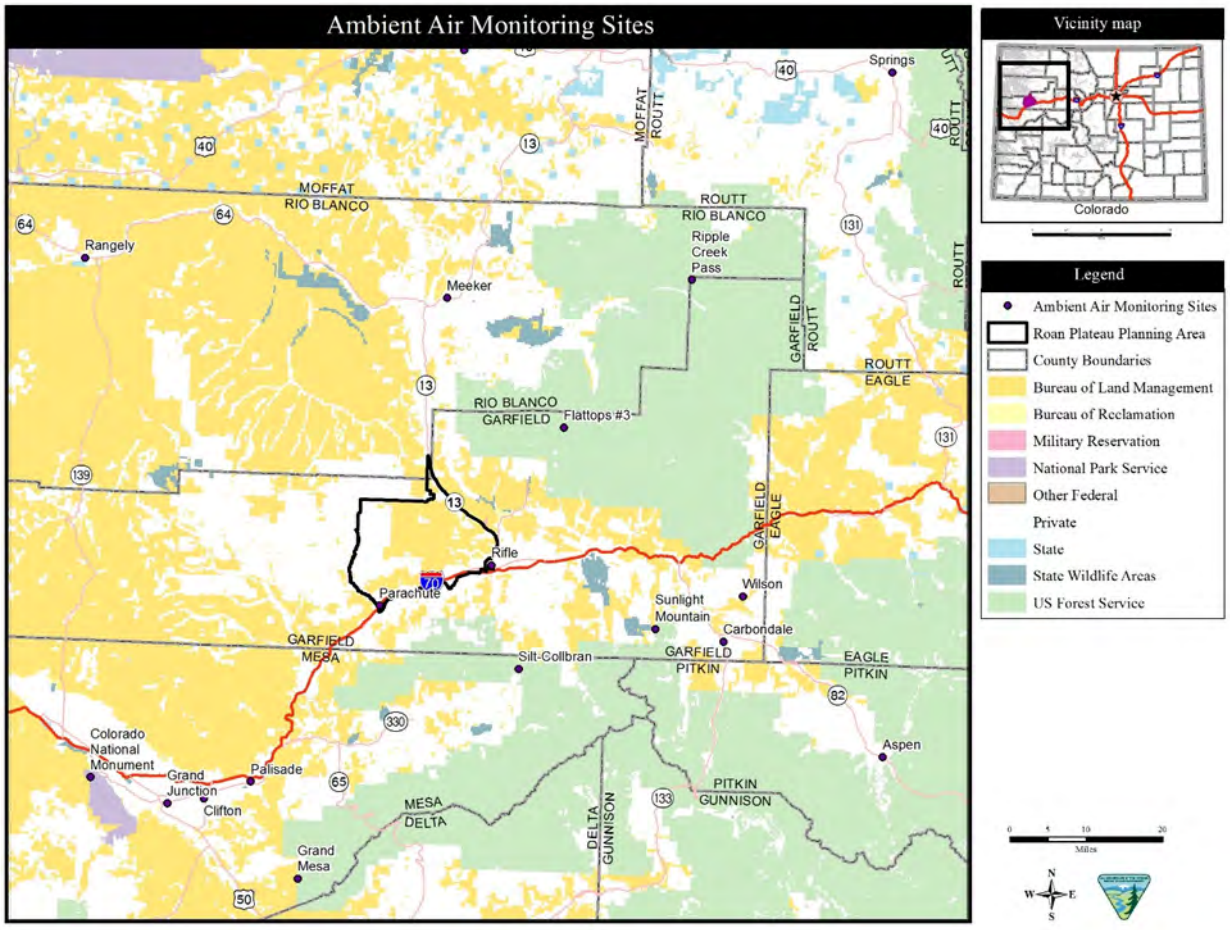


Figure 3.2-3 Ambient Air Quality Monitor Locations

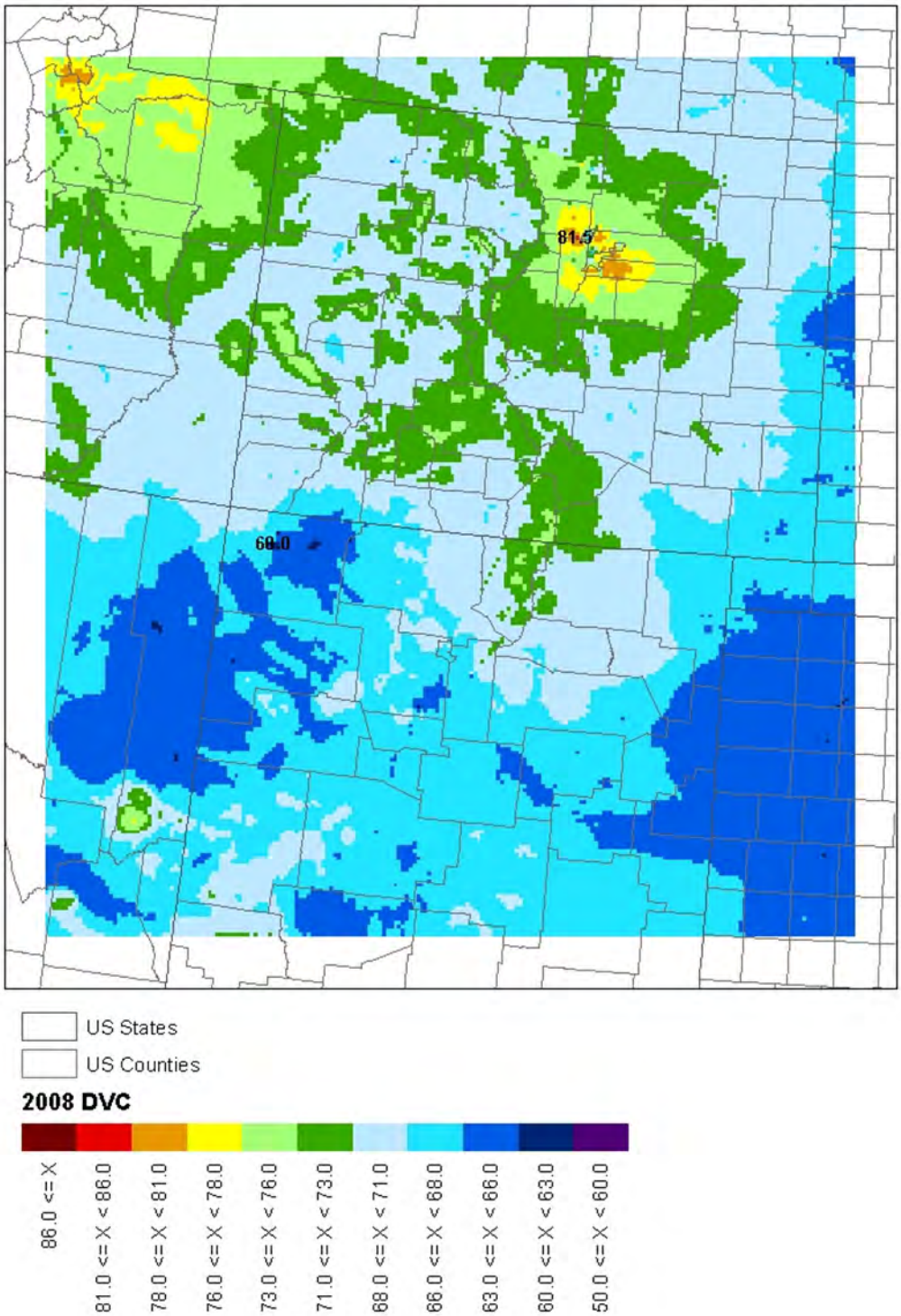


Figure 3.2-4 2008 Ozone Design Value Concentration

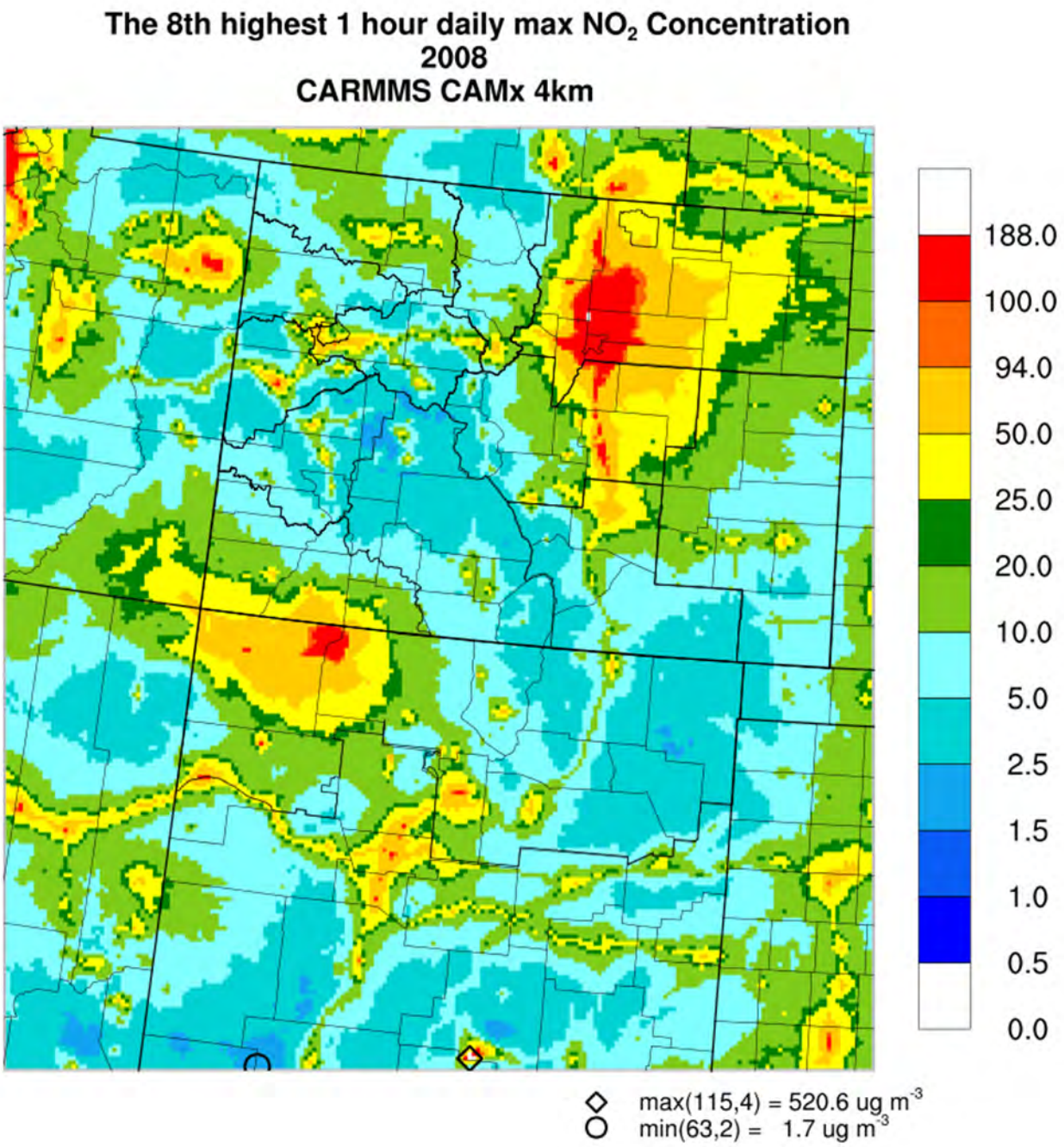


Figure 3.2-5 **8th Highest 1 Hour Daily Max NO_2 Concentration 2008**

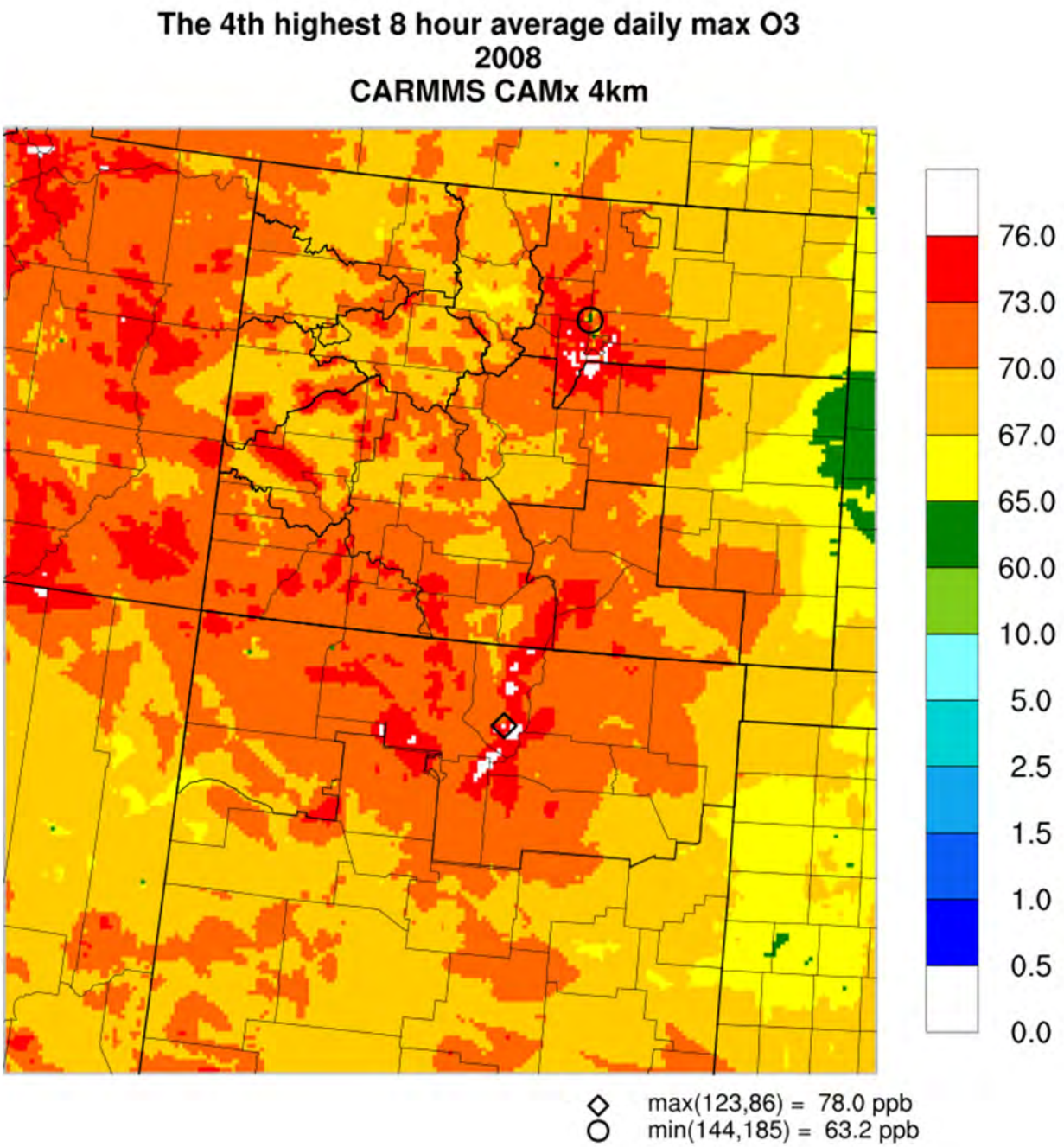


Figure 3.2-6 **4th Highest 8 Hour Average Daily Max O_3, 2008**

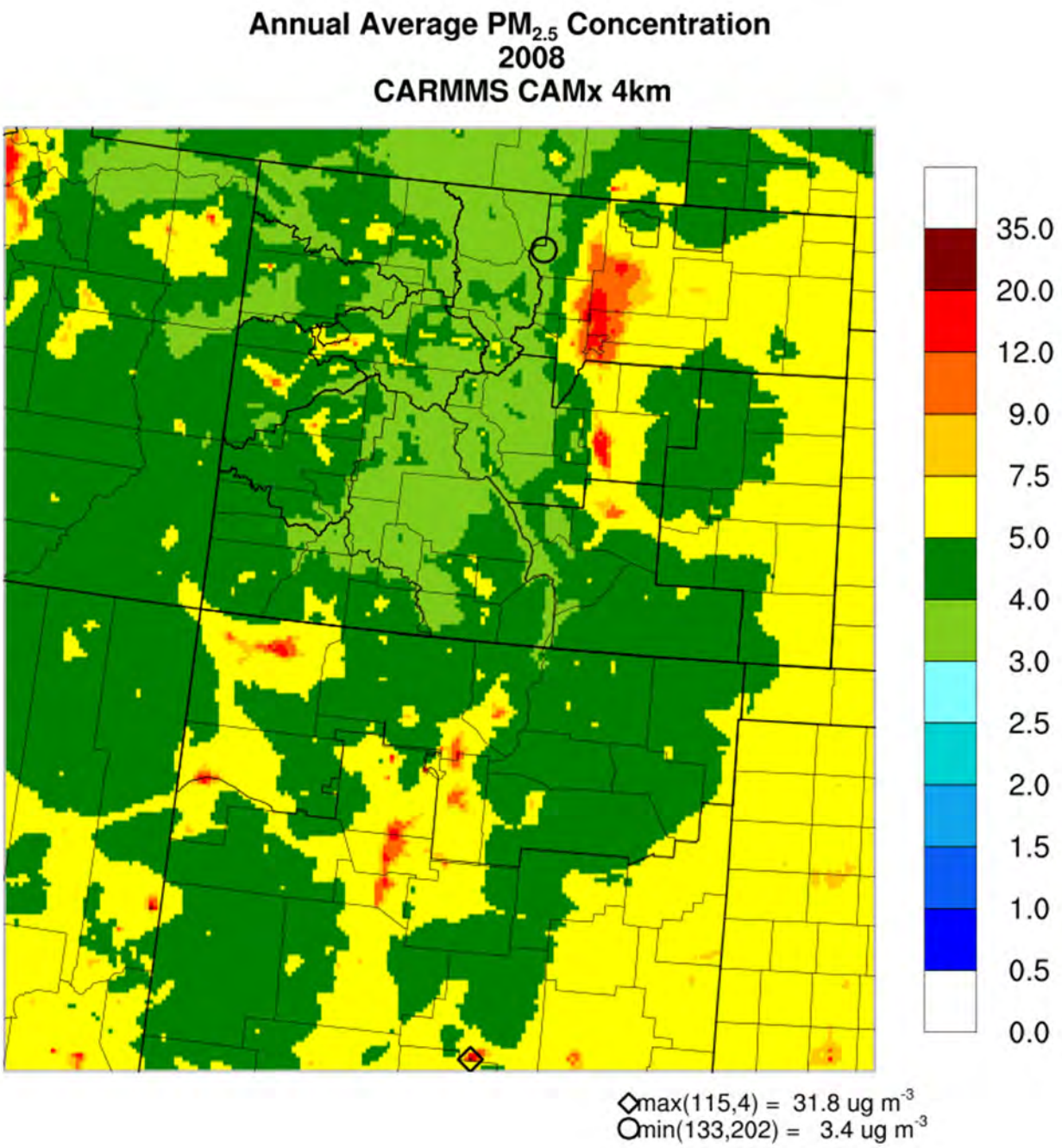


Figure 3.2-7 Annual Average $PM_{2.5}$ Concentration, 2008

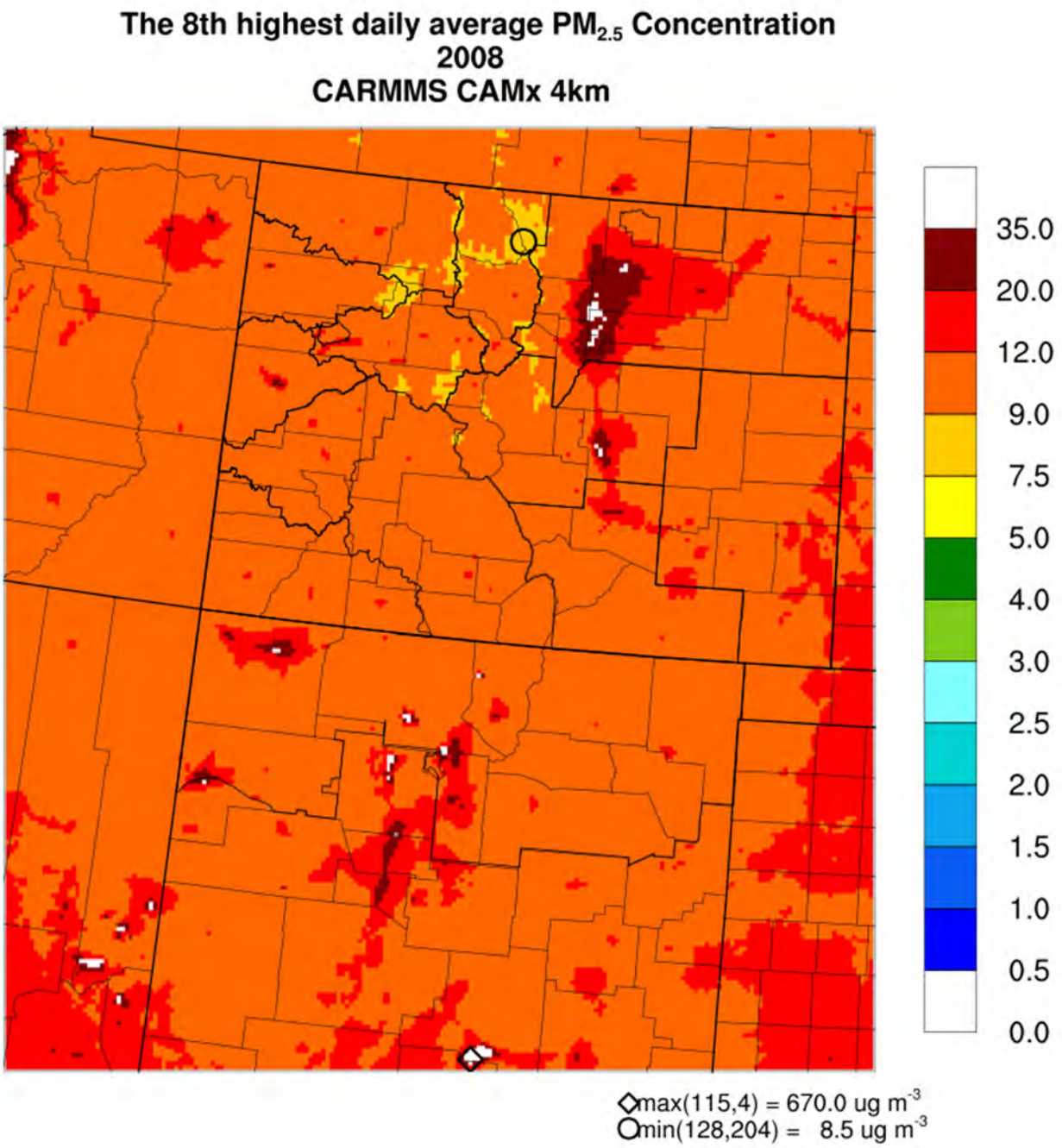


Figure 3.2-8 **8th Highest Daily Average $PM_{2.5}$ Concentration, 2008**

Table 3.2.17 Year 2008 Eight-Hour Ozone Design Value Concentrations for Colorado

Monitor Site	*Latitude*	*Longitude*	*County*	*Ozone Design Value (parts per billion [ppb])*
CO_Adams_3001	39.8381	-104.9498	Adams	71.5
CO_Boulder_0011	39.9572	-105.2385	Boulder	77.3
CO_Denver_0014	39.7518	-105.0307	Denver	70.3
CO_Douglas_0004	39.5345	-105.0704	Douglas	78.3
CO_El Paso_0013	38.9583	-104.8172	El Paso	68.0
CO_El Paso_0016	38.8531	-104.9013	El Paso	70.3
CO_Jefferson_0002	39.8003	-105.1000	Jefferson	75.0
CO_Jefferson_0005	39.6388	-105.1395	Jefferson	74.3
CO_Jefferson_0006	39.9128	-105.1886	Jefferson	82.0
CO_Jefferson_0011	39.7437	-105.1780	Jefferson	76.3
CO_La Plata_1004	37.3039	-107.4842	La Plata	70.0
CO_La Plata_7001	37.1368	-107.6286	La Plata	66.0
CO_La Plata_7003	37.1026	-107.8702	La Plata	67.0
CO_Larimer_0007	40.2772	-105.5450	Larimer	74.3
CO_Larimer_0011	40.5925	-105.1411	Larimer	78.0
CO_Larimer_1004	40.5775	-105.0789	Larimer	67.3
CO_Montezuma_0101	37.1983	-108.4903	Montezuma	69.3
CO_Weld_0009	40.3864	-104.7374	Weld	72.7

Table 3.2.18 below presents four years of monitoring data for HAPs in Garfield County, where the Planning Area is located. The data presented in Table 3.2.18 are maximum measured values. Unlike criteria pollutants, the CAA does not establish ambient concentration standards for HAPs. Figure 3.2-9 below shows the HAP monitor locations in relation to the Planning Area.

Table 3.2.18 HAP Air Quality Monitoring Data

County	City	Pollutant	Monitored Values			
			2011	2012	2013	2014
Garfield	Carbondale	Formaldehyde	N/A	3.20 μg/m^3	1.84 μg/m^3	2.09 μg/m^3
		Benzene	N/A	1.07 μg/m^3	1.28 μg/m^3	1.15 μg/m^3
		1,3-Butadiene	N/A	0.31 μg/m^3	0.12 μg/m^3	0.13 μg/m^3
		Acetaldehyde	N/A	2.43 μg/m^3	1.80 μg/m^3	2.07 μg/m^3
	Silt	Formaldehyde	1.16 μg/m^3	3.07 μg/m^3	1.97 μg/m^3	1.60 μg/m^3
		Benzene	2.64 μg/m^3	0.46 μg/m^3	4.79 μg/m^3	1.61 μg/m^3
		1,3-Butadiene	0.15 μg/m^3	0.27 μg/m^3	0.33 μg/m^3	0.22 μg/m^3
		Acetaldehyde	0.74 μg/m^3	1.62 μg/m^3	1.80 μg/m^3	1.08 μg/m^3
	Parachute	Formaldehyde	2.62 μg/m^3	2.33 μg/m^3	2.46 μg/m^3	2.58 μg/m^3
		Benzene	1.69 μg/m^3	2.96 μg/m^3	5.38 μg/m^3	2.92μg/m^3
		1,3-Butadiene	0.33 μg/m^3	0.28 μg/m^3	0.16 μg/m^3	0.22 μg/m^3
		Acetaldehyde	1.51 μg/m^3	1.55 μg/m^3	1.44 μg/m^3	1.35μg/m^3
	Rifle	Formaldehyde	3.39 μg/m^3	2.83 μg/m^3	4.42 μg/m^3	1.97 μg/m^3
		Benzene	2.79 μg/m^3	3.06 μg/m^3	4.79 μg/m^3	2.51 μg/m^3
		1,3-Butadiene	0.53 μg/m^3	0.57 μg/m^3	0.33 μg/m^3	0.45 μg/m^3
		Acetaldehyde	2.34 μg/m^3	2.34 μg/m^3	2.07 μg/m^3	1.17 μg/m^3

Source: EPA 2015a.

Key:
N/A = Monitor value not available
μg/m^3 = micrograms per cubic meter

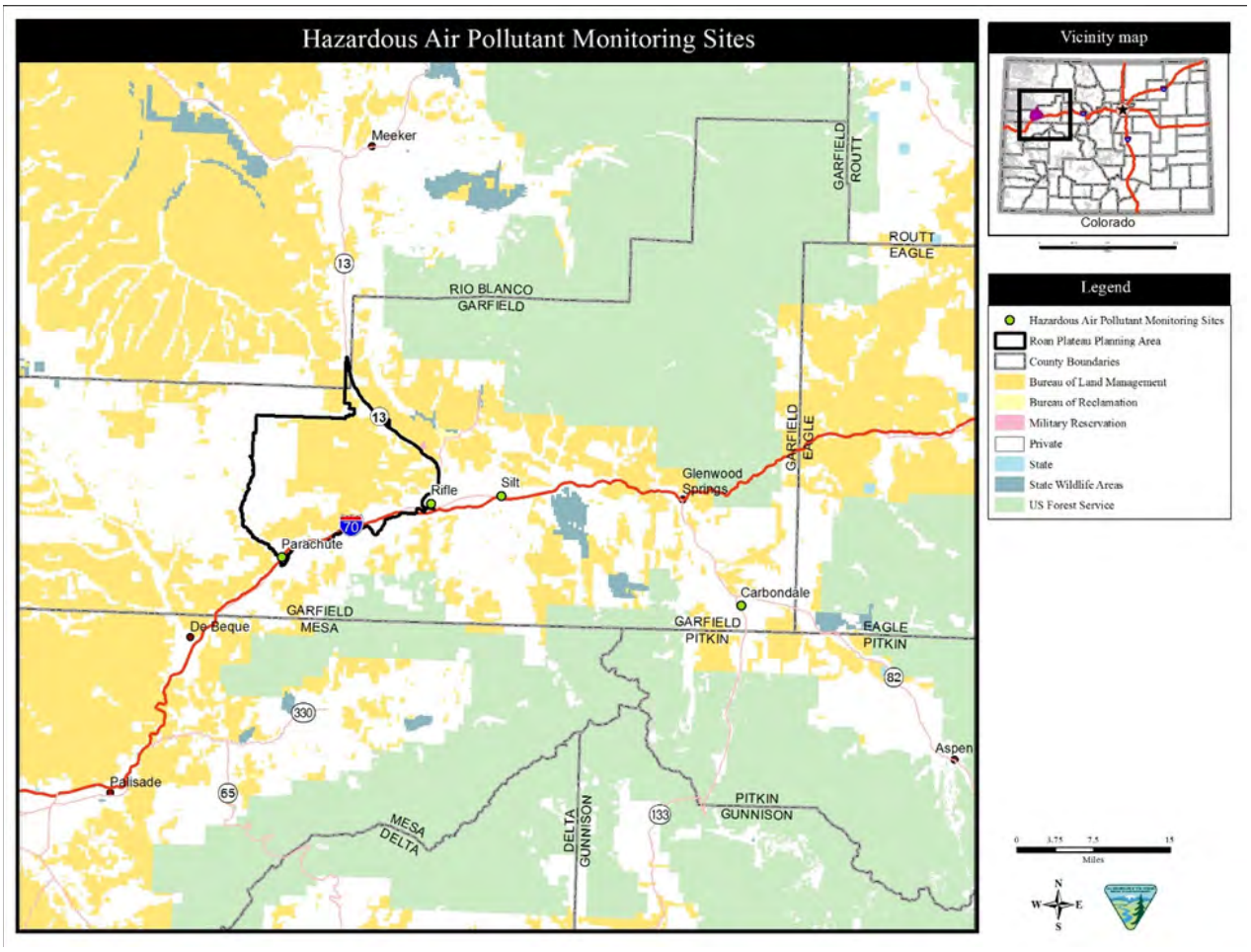


Figure 3.2-9 Hazardous Air Pollutant Monitor Locations

Air Quality Related Values

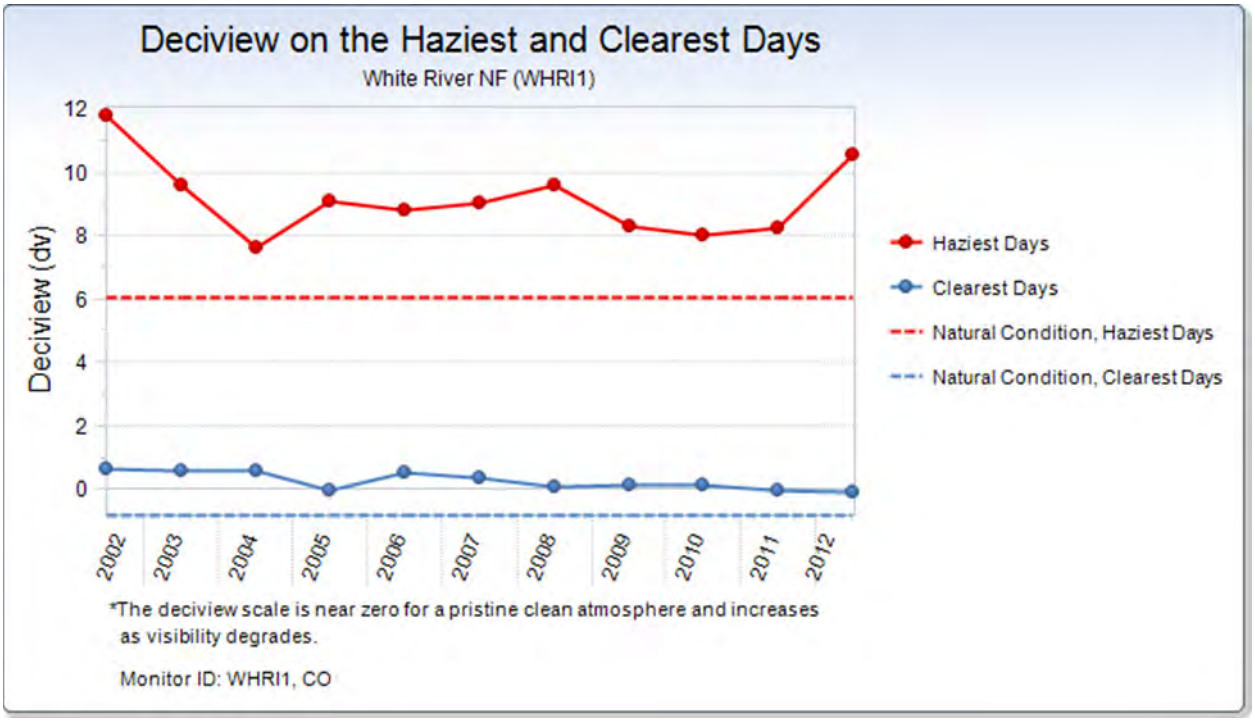
Air quality related values (AQRVs) are resources sensitive to air quality, e.g., vegetation, soils, water, fish and wildlife, and visibility.

AQRV Impact Metric: Visibility Impairment

Visibility impairment is caused by the scattering of light by gases and particles in the atmosphere. Man-made emissions of air pollutants contribute to the loading of particulates in the atmosphere that cause haze. Fine particulates ($PM_{2.5}$) are the largest contributors to haze. Visual range, i.e., the greatest distance at which an observer can distinguish an object from the background, is an easily understood way to describe visibility. Visual range, however, is not linear, with perceived changes in visibility. For instance, a 5-kilometer (km) change in visual range is more easily seen when the air is quite clear than when it is hazy. For this reason, visibility is usually described in terms of an index (called the deciview) that is linear with respect to perceived changes in visibility. A change of 1.0 deciview is equivalent to a 10 percent change in light extinction and represents a just noticeable change in visibility. The higher the deciview, the less a person can see into the distance.

Visibility at Class I areas is monitored through IMPROVE program, which maintains a network of particulate monitors. Visibility on the 20 percent clearest and haziest days is tracked to measure progress

toward the national visibility goal as required by the Regional Haze Rule. The IMPROVE monitor closest to the Planning Area is located at White River National Forest. Figure 3.2-10 shows trends in annual mean visibility on the clearest and haziest days at White River National Forest. The plots show the data overlaid with the trend in time. In general, trends with a negative slope indicate better atmospheric conditions for each potentially affected area.



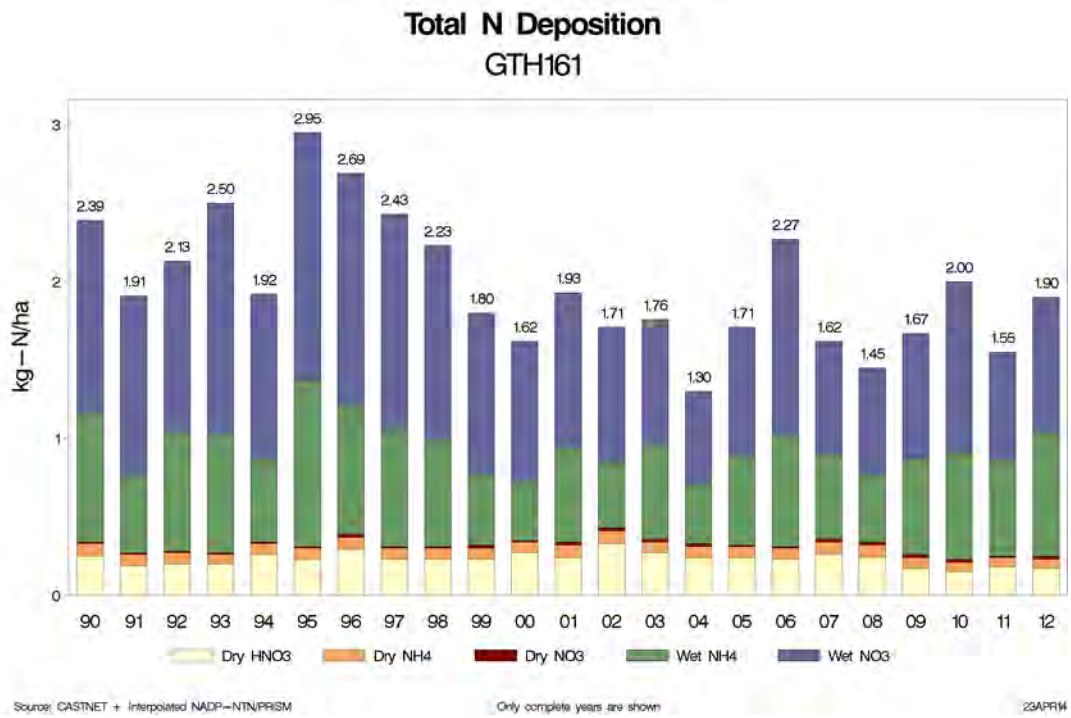
Source: VIEWS 2015.

Figure 3.2-10 AQRV Visibility Data for White River National Forest

AQRV Impact Metric: Atmospheric Deposition

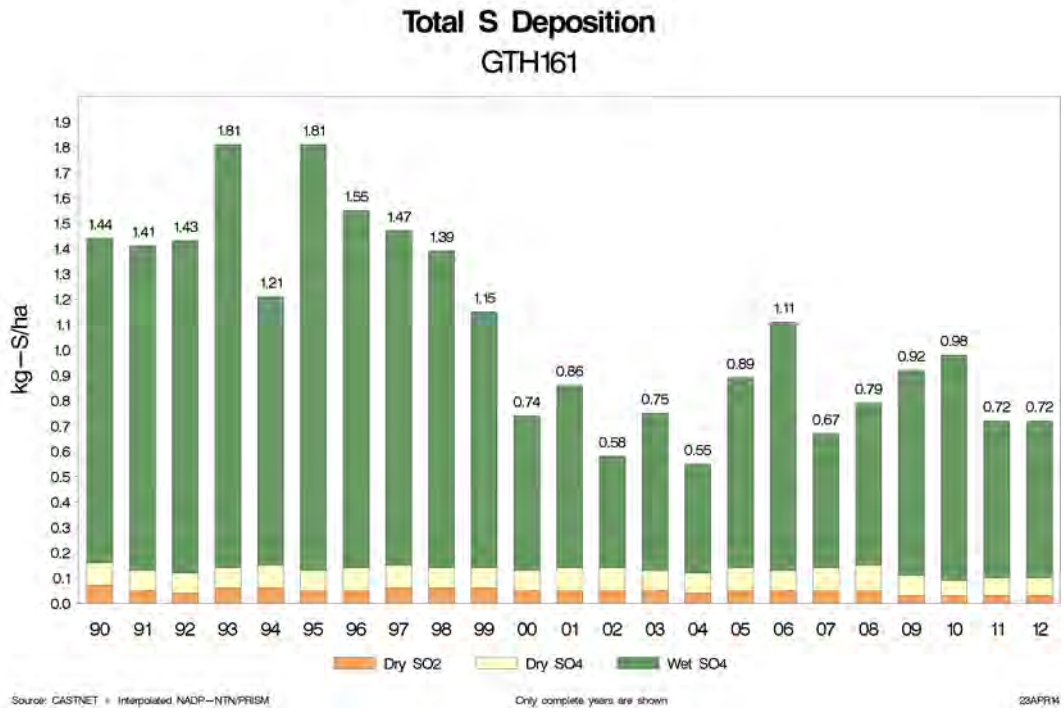
Air pollutants can be deposited through precipitation (such as rain or snow) or by dry settling processes to surfaces on the ground such as soils and water bodies. Deposition can cause excess nutrient loading in native soils and acidification of the landscape, which can lead to declining buffering capacity changes in sensitive stream and lake water chemistries (commonly referred to as acid neutralization change (ANC)). The chemical components of wet deposition include sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4); the chemical components of dry deposition include SO_4, SO_2, (NO_X) NO_3, NH_4, and nitric acid (HNO_3). A recent 2014 NPS Study suggests that the critical nitrogen load value for high elevation surface water in all natural areas of Colorado is 2.3 kilograms per hectare per year (kg/ha-yr). The NPS Technical Guidance on Assessing Impacts on Air Quality in NEPA and Planning Documents suggests that critical sulfur load values above 3 kg/ha-yr may result in moderate impacts (NPS 2011).

Clean Air Status and Trends Network (CASTNET) is a national air quality monitoring network designed to provide data to assess trends in air quality, atmospheric deposition, and ecological effects due to changes in air pollutant emissions. The CASTNET monitor closest to the Planning Area is the Gothic site located in Gunnison County, Colorado. Figures 3.2-11 and 3.2-12 provide current trend data for deposition at the Gothic site.



Source: CASTNET 2015.

Figure 3.2-11 Total Nitrogen (N) Deposition for the Gothic Site in Gunnison County



Source: CASTNET 2015.

Figure 3.2-12 Total Sulfur (S) Deposition for the Gothic Site in Gunnison County

National Emissions Inventory Data (2011)

Potential oil and gas development for the Planning Area would take place in Garfield County, Colorado. Existing air quality conditions are generally a function of air pollutant emissions loading within any particular region. Table 3.2.19 shows estimated total emissions within Garfield County for 2011. Colorado State totals and the percentage of Colorado State total emissions generated in Garfield County are also shown. The data were compiled from EPA's Technology Transfer Network, Clearinghouse for Inventories & Emission Factors.

Table 3.2.19 2011 Emission Inventory Data for Garfield County, Colorado (tons)

Garfield	*PM_{10}*	*$PM_{2.5}$*	*VOCs*	*CO*	*NO_X*	*SO_2*	*CO_2*	*CH_4*	*N_2O*	*NH_3*	*HAPs[1]*
Agriculture	42	8	NR	NR	NR	NR	NR	NR	NR	281	NR
Biogenics	NR	NR	27,634	4,463	290	NR	NR	NR	NR	NR	637
Bulk Gasoline Terminals	NR	NR	95	NR	NR	NR	NR	NR	NR	NR	14
Commercial Cooking	33	30	4	12	NR	NR	NR	NR	NR	NR	1
Dust	2,627	312	NR	NR	NR	NR	NR	NR	NR	NR	
Fires	203	172	469	1,993	27	15	23,518	97	NR	33	34
Fuel Comb	242	240	2,301	4,171	6,128	117	NR	NR	NR	19	382
Gas Stations	NR	NR	320	NR	NR	NR	NR	NR	NR	NR	4
Industrial Processes	871	336	86,306	6,370	6,858	40	NR	NR	NR	NR	2,529
Miscellaneous	NR	NR	27	NR	NR	NR	NR	NR	NR	NR	2
Mobile	148	110	1,197	12,773	3,103	15	546,197	37	18	32	256
Solvent	0	0	336	7	6	0	NR	NR	NR	NR	34
Waste Disposal	4	1	21	0	0	0	NR	NR	NR	NR	0
Garfield County Totals	***4,170***	***1,210***	***118,709***	***29,788***	***16,413***	***187***	***569,714***	***134***	***18***	***365***	***3,892***
Colorado State Totals	***329,190***	***101,828***	***1,420,145***	***1,575,920***	***337,093***	***55,718***	***36,101,025***	***20,318***	***1,378***	***79,361***	***62,122***
Percent of CO State Emissions in Garfield County	**1.3%**	**1.2%**	**8.4%**	**1.9%**	**4.9%**	**0.3%**	**1.6%**	**0.7%**	**1.3%**	**0.5%**	**6.3%**

Source: EPA 2011.

Note:
[1] The hazardous air pollutants (HAPs) monitored were benzene, toluene, ethyl-benzene, xylene, formaldehyde, and hexane.

Key:
NR = Not Reported

3.2.5.4 Climate

There is broad scientific consensus that humans are changing the chemical composition of earth's atmosphere. Activities such as fossil fuel combustion, deforestation, and other changes in land use are resulting in the accumulation of trace greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and several industrial gases in the Earth's atmosphere. An increase in GHG emissions is said to result in an increase in the earth's average surface temperature, primarily by trapping and thus decreasing the amount of heat energy radiated by the earth back into space. The phenomenon is commonly referred to as global warming. Global warming is expected, in turn, to affect weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, which are collectively referred to as climate change.

The Intergovernmental Panel on Climate Change (IPCC) has predicted that the average global temperature rise between 1990 and 2100 could be as great as 5.8°Celsius (C) (10.4° Fahrenheit [F]), which could have massive deleterious impacts on the natural and human environments. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and the burning of fossil carbon fuel sources have caused GHG concentrations to increase measurably, from approximately 280 parts per million (ppm) in 1750 to 400 ppm in 2014 (as of April). The rate of change has also been increasing as more industrialization and population growth is occurring around the globe. This fact is demonstrated by data from the Mauna Loa CO_2 monitor in Hawaii that documents atmospheric concentrations of CO_2 going back to 1960, at which point the average annual CO_2 concentration was recorded at approximately 317 ppm. The record shows that approximately 70 percent of the increases in atmospheric CO_2 concentrations since pre-industrial times occurred within the last 54 years (ESRL 2014).

Greenhouse gases play a role in the natural environment by absorbing the sun's heat. As the sun's energy radiates back from the Earth's surface toward space, these gases trap the heat in the atmosphere, keeping the planet's surface warmer than it would otherwise be. Increases of atmospheric greenhouse gases result in additional warming of the Earth's atmosphere. Carbon dioxide equivalents (CO_{2e}) is a metric used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). For instance, over a 100 year period the GWP of methane (CH_4) is estimated to be about 25 times greater than carbon dioxide (CO_2), so its carbon dioxide equivalent (CO_{2e}) is 25. The carbon dioxide equivalent (CO_{2e}) of nitrous oxide (N_2O) is 298 (EPA 2011).

Globally the average annual temperature has risen since 1900 by about 1.5°F and is expected to rise another 2°F to 10°F by 2100. The average annual temperature in the United States has risen by a comparable amount over the same time period but is expected to rise more than the global average over this century (Karl et al. 2009).

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Upland Vegetation and Riparian/Wetland Areas

Information describing the Affected Environment for upland vegetation and riparian/wetland areas is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed; including integration of the results of the Roan Cliffs Abbreviated Land Health Assessment (BLM 2013a).

3.3.1.1 Introduction

Vegetation is a resource that must be addressed under the BLM resource management planning process (BLM 2001a). Plant species and associations also comprise a large portion of the ecological richness, uniqueness, and diversity values identified as being a major issue within the Planning Area.

A number of surveys, National Environmental Policy Act (NEPA) documents, and land health assessments have mapped and described in detail the vegetation in the Planning Area (TRW 1981, BLM 1991, Colorado Natural Heritage Program [CNHP] 1997a and 2001) as well the Rifle-West Land Health Assessment (BLM 2005b) and the Roan Cliffs Abbreviated Land Health Assessment (BLM 2013a). An extensive map of plant communities within two regional watersheds, the Parachute-Roan Creek and the Colorado River-Plateau Creek, was finalized in 2001 under the auspices of Colorado Parks and Wildlife (CPW) (formerly Colorado Division of Wildlife). All of these studies are integrated into this resource section.

The current condition and assessment of trends for upland and riparian/wetland plant communities and noxious weeds are described in Section 3.3.1.2. Botanical nomenclature follows Weber and Wittmann (2012). Past conditions and uses are also briefly described. Special status plants and other species or communities of special concern are discussed in Section 3.3.3. These include ESA listed threatened or endangered species, Federal candidate species, BLM and USFS sensitive species, and selected other plant species or communities considered rare or imperiled.

3.3.1.2 Major Plant Community Types

The physical environment of the Planning Area is created by an unusually variable combination of topography, aspect, hydrology, soils, and exposed rock outcrops. This complex environment supports ten major plant communities. Table 3.3.1 lists these species' relative areas and general conditions. The "general vicinity" referenced in the table comprises the two regional watersheds (Parachute-Roan Creek and Colorado River-Plateau Creek). These communities form two distinct mosaics, determined by their relative position above or below the rim (Map 19).

Table 3.3.1 Vegetation Community Types and Condition in BLM Lands in Planning Area

Community Type	*Acres*	*Percent*	*General Condition*
Agricultural land	1,400	1.1	NI
Aspen woodland	11,390	9.0	Good
Coniferous forest	6,760	5.3	Healthy
Mountain grassland	4,960	3.9	Good
Mixed mountain shrubland	31,770	25.0	Healthy, diverse, and productive
Pinyon/juniper woodland	23,590	18.6	Variable
Riparian/wetland	1,430	1.1	Variable
Sagebrush shrubland	27,400	21.6	Healthy, diverse, and productive above rim; poor to fair below
Semi-desert shrubland	5,330	4.2	Good above rim; poor to fair below
Shale barrens	1,600	1.3	Good
Unvegetated [a]	10,880	8.6	NA
Total	**73,800**	**100.0**	--

Table 3.3.1 Vegetation Community Types and Condition in BLM Lands in Planning Area

Community Type	Acres	Percent	General Condition

Note:
[a] Includes rock, exposed soil, talus slopes, rock outcrops, and surface water.

Key:
NA = not applicable
NI = no information

Lands Atop the Plateau

The rim of the Roan Plateau is defined by the steep, largely unvegetated Roan Cliffs. Above the Southeast Cliffs, the more mesic conditions associated with higher elevation, less-severe topography, exposure, and more fertile soils support plant communities typically associated with lower mountainous regions of Colorado. The undulating plateau surface is dominated by woodlands of quaking aspen (*Populus tremuloides*) on north- and northeast-facing slopes, and two shrubland types on south- and west-facing slopes and drier ridgetops. The two upland shrub communities occur on ridgetops and drier south- and west-facing slopes atop the plateau: sagebrush shrubland, dominated by mountain sagebrush (*Seriphidium vaseyanum*) with Utah serviceberry (*Amelanchier utahensis*) and mountain snowberry (*Symphoricarpos rotundifolius*); and mixed mountain shrubland, including Gambel's oak (*Quercus gambelii*), mountain snowberry, Utah serviceberry, mountain-mahogany (*Cercocarpus montanus*), and Douglas (sticky) rabbitbrush (*Chrysothamnus viscidiflorus*).

The Roan Plateau is dissected by Trapper Creek, Northwater Creek, East Middle Fork Parachute Creek, Ben Good Creek, and East Fork Parachute Creek and their tributaries. North-facing slopes along the drainages are generally cloaked by stands of aspen, with mixed conifer woodlands of Douglas-fir (*Pseudotsuga menziesii*) and subalpine fir (*Abies bifolia*) along the cooler north-facing slopes of the deeper canyons and valleys. In lower reaches of these drainages, the opposite slopes support scattered individual Douglas-fir within a matrix of shale barrens and mountain grasslands. Sagebrush shrublands and mountain grasslands form a narrow band along the top of the cliffs. Two of the grasslands are considered significant plant communities (Section 3.3.3).

Moist meadow wetlands, dominated by herbaceous species, are associated with the headwaters of drainages. Riparian shrublands that support willows (*Salix* spp.), elderberry (*Sambucus* spp.), gooseberry (*Ribes* spp.), and riparian grasses are found along the bottoms of the major drainages.

Lower reaches of the main drainages atop the plateau—East Middle Fork Parachute Creek, East Fork Parachute Creek above the waterfalls, and the canyon section of Northwater Creek—support a narrow ribbon of coniferous woodland dominated by blue spruce (*Picea pungens*) and Engelmann spruce (*P. engelmannii*) with a mosaic of mesic shrubs. Deciduous woodlands characterized by narrowleaf cottonwood (*Populus angustifolia*), box-elder (*Negundo aceroides* subsp. *interius*), and riparian shrubs are found below the falls in East Fork Parachute Creek and in upper Cottonwood, Hayes, Wheeler, Sharrard, and Thirty-Two Mile Gulches.

Canyon wall seeps, or "hanging gardens" are unique wetland features limited to seep areas on canyon walls where year-round water is available and the substrate is soft enough to allow roots to penetrate deeply, holding plants on the walls, which are often extremely steep. The hanging gardens are most abundant on the north-facing walls along the East Fork Parachute Creek and Northwater Creek where Green River shale beds are exposed. This wetland type is characterized by the presence of hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*), an endemic Colorado plant (i.e., occurring only in

Colorado) that is restricted to calcareous seeps on steep canyon walls. Two of the riparian woodlands and the hanging garden seeps are considered significant plant communities (Section 3.3.3).

Lands Below the Rim

Where it wraps around the eastern edge of the plateau, the Roan Cliffs escarpment becomes less steep and is dissected by a number of ravines. The north-facing ravine slopes support solid stands of mature ("old growth") Douglas-fir, some of which are considered remnant communities.

Just below the steepest cliffs, a mixed mountain shrubland with isolated stands of aspen and Douglas-fir gives way to more extensive pinyon/juniper (*Pinus edulis/Juniperus osteosperma*) woodlands on the lower west-, south-, and east-facing slopes. Douglas-fir persists on some north-facing slopes through portions of this transitional zone but is finally replaced by mixed mountain shrublands of Gambel's oak, Utah serviceberry, and mountain-mahogany.

The dissected ridges and ravines extend away from the cliffs and onto the broad floor of the Colorado River valley, where pinyon/juniper woodland and slopes of mountain sagebrush grade into semi-desert shrubland of shadscale *(Atriplex confertifolia)*, common saltbush (*Zuckia brandegei*), and greasewood (*Sarcobatus vermiculatus*), with localized, sometimes large, stands of basin big sagebrush (*Seriphidium tridentatum*). This elevation gradation reflects the progressively hotter, drier conditions extending from the base of the cliffs to the flat terrain along I-70, representing a vertical distance of more than 1,000 feet.

3.3.1.3 Current Condition and Trends

Upland Vegetation

As noted in Section 3.3.1.1, upland vegetation in the Planning Area is a diverse resource, providing a large amount of the local and regional biodiversity and ecological value. Grazing allotments in portions of the Planning Area were assessed for land health in the Roan Cliffs Landscape Unit (BLM 2001d), Rifle Creek Landscape Unit (BLM 2002b), and Rifle-West Landscape Unit (BLM 2005b). These assessments indicated that upland plant communities were in generally good to excellent condition in terms of the upland vegetation (Land Health Standard #3) above the rim. For most sites, it was noted that distribution of native plant communities appeared sufficient to ensure sustainability, and most communities appeared to have mixed-age classes in sufficient amounts to sustain recruitment. Exceptions are discussed below. Below the rim, most low-elevation sagebrush and pinyon-juniper sites were either marginally meeting or not meeting the standards. The 2013 assessment found that approximately 92 percent of the upland areas atop the plateau met the standard. The other 8 percent were not meeting the standard due to lack of native perennial vegetation, excessive bare ground, and abundance of noxious weeds and other invasive species caused primarily by livestock grazing and loafing.

Most aspen stands on top of the plateau were described as mature during the land health assessments in 1999, and 2013, and some were becoming overmature or decadent. The presence of numerous aspen sprouts and saplings in some stands, combined with a lack of young conifers, suggests that these stands are beyond late-seral stage and, instead, may be climax communities (i.e., self-sustaining rather than transitional to coniferous forest).

In pinyon/juniper areas below the cliffs, community condition was variable. Areas at higher elevations and on steeper and north-facing slopes tended to be in good condition with evidence of regeneration, including dense canopy and an understory of shrubs and grasses. However, these areas could be susceptible to fire, as ladder fuels are available and the canopy is deemed dense enough to carry a crown fire. Stands at lower elevations or south-facing slopes often consisted of mature trees with little understory. Shrubs tended to be old and decadent, with little or no recruitment.

Semi-desert and sagebrush shrublands at the lowest elevations were in poor to fair condition, meeting Land Health Standard #3, but with problem areas. The shrub stands are even-aged with little evidence of new recruitment. In Cottonwood Gulch grazing allotment, monitoring data from 2001 indicated an understory comprising mostly annual grasses and forbs, with cheatgrass (*Anisantha tectorum*) being a dominant species. Monitoring data from the mid-1990s noted few perennial grasses in shrub interspaces in the Webster Park allotment and a large amount of cheatgrass. In other areas within this community, the herbaceous understory was poor, dominated by prickly pear cactus (*Opuntia* spp.), cheatgrass, and annual forbs. Several areas in the Hubbard Mesa grazing allotment were noted to be in moderate to extreme departure from the upland vegetation standard (Land Health Standard #3).

Riparian/Wetland Vegetation

Several types of riparian/wetlands are found within the Planning Area. These include moist meadows, riparian shrublands, riparian woodlands, and canyon wall seeps. All of these communities occur as narrow strips that are sustained by surface water, groundwater discharge, or a combination of the two.

Wetland areas have characteristic soils, hydrology, and plant associations that develop in response to persistent soil saturation during a substantial portion of the growing season. Riparian areas are plant communities that are primarily influenced by proximity to a stream or, less commonly, a pond or lake (e.g., see BLM 1988a). In the arid and semi-arid western United States, including the Planning Area, streams capable of sustaining riparian habitat are often ephemeral (including features termed “washes” or “gulches”), meaning that they carry water only in response to heavy or protracted rainfall or snowmelt.

Riparian may or may not be wetlands, and wetlands may or may not be associated with riparian areas. Thus, the terms are distinct but not mutually exclusive. Regardless, both types of habitats are important because of the presence of water and the increased vegetation diversity (both structure and composition) that the water sustains. Healthy riparian systems are recognized as being important for many species of wildlife. In Colorado, for example, CPW rates riparian areas as the most important habitat type in the State, in terms of both overall wildlife species richness and the number of special status species present.

Riparian areas are also known for their ability to filter sediments and pollutants adsorbed to those sediments, contribute to groundwater recharge, reduce flood energy, extend seasonal streamflow, improve stream habitat for aquatic life (through a combination of increased thermal cover, bank stability, and sources of invertebrate and vegetal food items), and provide recreational and scenic values (BLM 1998a). For these reasons, riparian/wetland habitats are considered an important resource in the Planning Area, despite representing approximately 1 percent of the land surface (Table 3.3.1).

Land Health Assessments

Riparian function and value throughout the Planning Area have been adversely affected by road construction, informal stream crossings, livestock grazing, and invasive weeds. Proper Functioning Condition (PFC) analysis (BLM 1998a) was used to assess the condition of a number of riparian reaches along creeks atop the Roan Plateau during the 1994, 1999, and 2013 land health assessments (BLM 2001d, 2014d). The condition assessments are summarized in Table 3.3.2 and discussed below.

Table 3.3.2 Proper Functioning Condition Assessments, Roan Plateau Planning Area

Assessment Year	Total Miles Assessed	Number of Miles Rated PFC	Miles Rated FAR			Miles Rated NF	Miles Rated as Non-Riparian
			Total	Downward Trend	Upward Trend		
1994	31.6	3.4	26.5	7.2	-	1.7	-
1999	33.8	8.6	24.6	-	24.6	0.6	-
2013	55.3	28.6	18.8	-	5.5	0.1	8.8

Sources: BLM 2001d, 2014d.

Key:
FAR = Functioning-at-Risk
NF = Non-functional
PFC = Proper Functioning Condition

In 1994, 31.6 miles were assessed: 10.8 percent (3.4 miles) were considered to be at PFC, 83.9 percent (26.5 miles) were found to be Functioning-at-Risk (FAR), and 5.4 percent (1.7 miles) were Non-Functional (NF). Of the reaches considered FAR, six of the sites (27.2 percent, 7.2 miles) had a downward trend.

In 1999, the assessment showed an improving trend for many of the same reaches (with an additional three sites, adding 2.2 miles): slightly more than 25 percent (8.6 miles) were found to be PFC, almost 73 percent (24.6 miles) were FAR, and slightly less than 2 percent (0.6 miles) were NF. All of the reaches that received a FAR rating were considered to be improving in condition and making progress towards meeting the riparian system Land Health Standard (#2). However, it was noted that grazing distribution was a concern in these areas, as the streambanks require vegetation cover to protect them from erosion and to trap sediment and debris. Proper grazing management was also a concern in terms of retaining adequate herbaceous cover, and limited utilization of woody riparian plant species was critical (BLM 2001d).

There has been some concern expressed by BLM staff that since the 1999 assessment, riparian conditions have reversed into a static or downward trend in some of these reaches (Fresques 2002). Distribution of grazing animals continues to be a concern in some areas. Approximately 8.9 miles of riparian areas below the cliffs were assessed for PFC in 2001. Of these, almost 60 percent (5.3 miles) were rated as PFC, and 42 percent (3.6 miles) were FAR. One 0.6-mile reach on Government Creek (Lower Reach 1) was ranked as FAR in a downward trend, due in part to OHV use in the area. A second reach (0.4 mile) assessed to be FAR in a downward trend may be caused by sheep trailing through the riparian zone. A final 2.6 miles was determined to be FAR with no apparent trend. The area around Fravert Reservoir (2 acres) was also assessed and determined to be at PFC.

Additional areas in Webster Park Gulch were visually assessed in 1995. At this time, Webster Park Gulch was considered to be in declining condition.

As part of a 2004 Land Health Assessment of the Rifle West Landscape Unit, Sharrard Gulch (1.2 miles) was determined to be a non-riparian system. Cottonwood Gulch (Upper and West Branches 1 and 2, 2.7 miles) was rated as PFC. Cottonwood Gulch (West Branch 3, 0.4 mile) was determined to be a non-riparian system. Cottonwood Gulch (Lower Branch, 0.6 mile) was rated as FAR with an upward trend. The causal factor for the FAR rating was due to road encroachment, which had changed flow patterns and had increased sediment within the riparian zone. The area appeared to be stabilizing. Hayes Gulch (2.4 miles) was also assessed and was rated as PFC (BLM 2005b).

For the Roan Cliffs Abbreviated Land Health Assessment conducted in 2013, a PFC assessment was performed on streams atop the Roan plateau (BLM 2013a). Results indicate that of the total 55.3 stream miles assessed, 52 percent (28.6 miles) were rated at PFC and 34 percent (18.8 miles) were rated as FAR. Within the FAR category, 5.5 miles were assessed as having an upward trend and the trend on the remaining 13.3 miles was not apparent. 0.2 percent (0.1 mile) was rated as NF. Non-riparian miles accounted for 16 percent (8.8 miles). The 2013 assessment concluded that the overall trend in riparian area health within the Planning Area appears relatively stable, with some areas improving and some declining relative to the earlier assessments used for the Roan FEIS analysis, depending on management actions and type of livestock.

Noxious Weeds and Other Invasive Non-Native Species

Invasive non-native plants ("weeds") pose an ever-increasing threat to native plant communities, wildlife habitat, croplands, rangelands, and human recreation throughout the world (Temple 1990). Many invasive non-natives are known to displace native plants and disrupt the structure and function of local ecosystems (Vitousek 1990). "Noxious weeds" are invasive non-natives designated as noxious pursuant to State law, in this case the Colorado Noxious Weed Act of 1996. In general, State-listed noxious weeds include the most invasive and most problematic species. As populations of noxious weeds and other invasive non-native plants increase in size and frequency, they tend to reduce the diversity of surrounding native plant communities, altering species composition and community structure, reducing habitat quality for wildlife, and affecting the aesthetic quality of the landscape. Because weeds can also displace desirable plant species in rangeland (Usher 1988, USFS 1998, Weiss and Murphy 1998, CNAP 2000), infestations may adversely affect forage quality and quantity for livestock.

To date, no systematic surveys or mapping projects for weeds have occurred for the Planning Area. However, land health assessments in 1999, 2001, 2004, and 2014 (BLM 2001d, 2002b, 2005b, 2014g) noted the presence of invasive non-natives, many of which are on the Colorado noxious weed list and/or the BLM national list of invasive weed species of concern (BLM 2014e). Noxious weeds and other invasive non-native plants species known to occur in the Planning Area are listed in Table 3.3.3 and discussed below.

Table 3.3.3 Noxious Weeds and Other Invasive Non-Native Plants in the Planning Area

Common Name	*Scientific Name*	*BLM List*	*Colorado List*
Bull thistle	*Cirsium vulgare*	√	√
Burdock	*Arctium minus*	√	√
Canada thistle	*Breea arvensis*	√	√
Cheatgrass	*Anisantha tectorum*	√	√
Common dandelion	*Taraxacum officinale*		
Halogeton	*Halogeton glomeratus*	√	√
Houndstongue	*Cynoglossum officinale*	√	√
Kentucky bluegrass	*Poa pratensis*		
Knapweeds	*Acosta* spp.	√	√
Kochia	*Bassia scoparia*		
Madwort	*Alyssum* spp.		
Musk thistle	*Carduus nutans*	√	√
Plumeless thistle	*Carduus acanthoides*	√	√

Table 3.3.3 Noxious Weeds and Other Invasive Non-Native Plants in the Planning Area

Common Name	Scientific Name	BLM List	Colorado List
Redstem filaree	*Erodium cicutarium*		√
Russian-thistle	*Salsola australis*		
Salt-cedar or tamarisk	*Tamarix chinensis*	√	√
Tumblemustard	*Sisymbrium altissimum*		
Yellow toadflax	*Linaria vulgaris*	√	√

Source: BLM 2014e.

In 2004, houndstongue (*Cynoglossum officinale*) was noted in almost 66 percent of the Land Health Assessment sites. The Land Health Assessment of 2013 found that noxious weeds such as houndstongue, Canada thistle (*Breea arvensis*), and musk thistle (*Carduus nutans*) are common along roads, in riparian areas and their adjacent terraces, and near water developments (BLM 2013a). While most of the noxious weeds are concentrated in disturbed areas, houndstongue is present throughout the landscape. As noted above, cheatgrass has been found in localized patches of light to moderate densities in grazing allotments below the cliffs. These were often closely associated with activities that resulted in surface disturbance to vegetation, such as roads and woodcutting. Additional weeds, such as burdock (*Arctium minus*), knapweeds (*Acosta* spp.), yellow toadflax (*Linaria vulgaris*), and salt-cedar or tamarisk (*Tamarix chinensis*) were noted as present at variable population sizes throughout the Planning Area during the land health assessments. Canada thistle occurs along almost every riparian reach on top of the plateau, sometimes in dense populations, and both Canada thistle and houndstongue occur along most roads on top of the plateau.

Other invasive non-natives observed in the Planning Area by BLM personnel, but not within the Land Health Assessment sites, include bull thistle (*Cirsium vulgare*), plumeless thistle (*Carduus acanthoides*), and Russian-thistle (*Salsola australis*). Another invasive non-native, Kentucky bluegrass (*Poa pratensis*), was found in 25 percent of the 1999 assessment sites but was rarely a dominant component. While this grass is not on the Colorado or BLM weed lists (Table 3.3.3), it is capable of out-competing native cool-season grasses under heavy grazing pressures (Rutledge and McLendon, n.d.) and is, therefore, an indicator of declining habitat quality in rangelands or riparian areas.

Weed management is an ever-increasing issue throughout BLM lands. All weed species are capable of rapidly establishing large populations. Therefore, even where not currently dominant, the presence of weeds in a community indicates conditions that could lead to future infestations, especially if conditions become more favorable for them (e.g., increased amounts of bare soil, increased dispersion of seeds along new roadways, protracted drought, and decreased cover by native species due to excessive grazing of livestock, off-route travel by vehicles, or wildland fire). The expected trend, absent of specific measures to control weeds, is for increasing sizes and numbers of weed populations. Invasive non-natives are, therefore, a threat to land health and multiple-use land management by contributing to loss of rangeland productivity, increased soil erosion, reduced species richness, reduced wildlife habitat quality, and reduced aesthetic quality.

3.3.1.4 Current Management and Desired Future Conditions

Upland Vegetation

The 1984 GSRA RMP contains no objectives for upland vegetation management. Upland vegetation within the Planning Area is currently managed to meet or exceed the upland vegetation Land Health

Standard (#3) (Roan FEIS Appendix F). This is specifically addressed in grazing allotment management plans as well as stipulations in the 1999 Record of Decision (ROD) and RMPA.

Vegetation management objectives in the 1997 WRRA RMP include conservation of healthy, diverse populations of native plants and communities that are sustainable and provide products for human use, enjoyment, and well-being, and the RMP notes that "conserving a site's ability to produce vegetation is key to sustainability." Another objective is to maintain a plant community mosaic that represents "successional stages and distribution patterns consistent with the natural disturbance and regeneration regimes." Desired plant communities (DPCs) are identified, and specific DPC goals are specified for consideration during activity plan development. In the small portion of the site within WRRA, upland vegetation is managed to enhance and maintain sustainable ecological condition of plant communities. Upland vegetation is inventoried and ecological status is determined using BLM site inventory procedures, and the vegetation is protected in accordance with the RMP objectives.

Riparian/Wetland Vegetation

The 1984 GSRA RMP contains no objectives for riparian and wetland management. These values were recognized in the BLM Riparian/Wetland Initiative (BLM 1991) that established national goals and objectives for managing these resources. One of the main goals of this initiative was to maintain or restore riparian/wetland systems so that 75 percent or more were in PFC by 1997.

Riparian and other wetland vegetation within the CRVFO is currently managed to meet or exceed the riparian system Land Health Standard (#2) (Roan FEIS, Appendix F). New allotment management plans for the lands above the rim incorporate additional riparian management objectives including "to achieve or be moving toward late seral stage riparian plant communities, to widen riparian zones, and decrease the greenline to greenline width." This is specifically addressed in grazing allotment management plans as well as stipulations in the 1999 ROD and RMPA. These include:

- **Riparian and Wetland Zones (NSO 2)** – Allows no long-term ground disturbing activities in these areas (80 acres);
- **CSU 2** – Moves proposed locations of ground disturbing activities more than 200 meters, if required to avoid these areas (2,620 acres); and
- **Major River Corridors (Colorado River) (NSO 3)** – Establishes a 0.5-mile protective buffer along either side of the Colorado River (440 acres).

The 1997 WRRA RMP states that riparian and wetland management objectives are to "achieve an advanced ecological condition on all high and medium priority riparian habitats except where resource management objectives, including PFC, require an earlier successional stage. The goal would be to have 75 percent of all riparian areas in the Resource Area in PFC within 5 years of approval of the RMP, ROD." For the small area of the Planning Area in the WRRA, riparian and wetland vegetation is managed by communities to enhance and maintain sustainable ecological condition. DPC goals are identified and considered during activity plan development. Vegetation is inventoried and ecological status is determined using BLM site inventory procedures. This vegetation is protected in accordance with the RMP objectives and in cooperation with Colorado Natural Areas programs and other interested parties.

Noxious Weeds

Noxious weed management is mandated on Federal lands by the Federal Noxious Weed Act of 1974 (amended by Management of Undesirable Plants of Federal Lands, Section 15, 1990) and the Carson-

Foley Act of 1968. Colorado BLM has a Weed Management Program based on the National BLM strategy, Partners Against Weeds (BLM 1996b), which focuses on integrated management of plant species included on the BLM National List of Non-Native Invasive Species. BLM is also a partner in the State of Colorado Strategic Plan for Noxious Weed Management (Colorado Department of Agriculture 2001).

The 1984 GSRA RMP has no objective for noxious weed management. The objective of noxious and problem weed management in the 1997 WRRA RMP is to manage noxious weeds so that they "cause no further negative environmental, aesthetic, or economic impact."

3.3.2 Terrestrial and Aquatic Wildlife

Information describing the Affected Environment for terrestrial and aquatic wildlife is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was complete as well as updated information and data, including wildlife species occurrence data; results of updated land health assessments; and integration of the Range-wide Conservation Assessment and Agreement and Strategy for CRCT.

3.3.2.1 Introduction

In general, distribution, abundance, patterns of movement, and seasonal use by wildlife are related to habitat type, quality, size, shape, connectivity, and historic or existing land use. At a more local level, interrelationships, such as competition and predation, may also affect individual species.

The Planning Area contains three broad landscape categories: (1) semi-desert habitats at lower elevations along I-70 and other nearby highways along the edges of the site; (2) transitional habitats immediately below the Roan Cliffs and on dissected slopes extending away from the cliffs; and (3) montane to marginal subalpine habitats at higher elevations above the rim. In addition to these major types are relatively narrow but ecologically important riparian habitats along streams, ranging from minor ephemeral tributaries to the Colorado River to two perennial tributaries: Parachute Creek and Government Creek.

Because of the ecological diversity related to the topographic extremes of the Planning Area, which are accentuated by its location near the boundary of the Colorado Plateau and Southern Rocky Mountain geographic provinces (Shelford 1963), the area supports a wide range of terrestrial vertebrate communities, including upper montane/lower subalpine species.

The following subsections describe existing fish and wildlife resources of the Planning Area and existing resource management. Special status species, including ESA listed, proposed, or candidate threatened or endangered species, State-listed threatened or endangered species, sensitive species as listed by the BLM and USFS, and other species of special concern, are described in Section 3.3.4.

3.3.2.2 Major Habitat Types

Wildlife habitat requirements vary significantly by species, but generally, healthy and sustainable wildlife communities require an appropriate mix of plant communities to provide cover, food (including direct sources such as foliage, fruit, and seeds and indirect sources such as insects attracted to the plants), and structure (including thermal cover, hiding cover, and sites for nesting, resting, or feeding). For many species, availability of water or specific types of physical habitat (e.g., rough topography, caves) is also critical.

The Planning Area contains seven habitat types roughly corresponding with plant community types (Section 3.3.1), one habitat type related to the presence of caves, and both lentic (standing water) and lotic (flowing water) aquatic habitat types. These are described below.

Semi-Desert Scrub

This community extends along I-70 west of Rifle and is formed on nearly level terrace deposits and adjacent fans north of the Colorado River. The community occupies 5,330 acres within the Planning Area, but only 730 acres on BLM land. The habitat is dominated by shadscale, saltbush, and greasewood, with localized areas of basin big sagebrush and a sparse understory of grasses and forbs. Because of the sparse forage and low height, this community is primarily used for nesting by certain songbirds and small mammals, for feeding by raptors and coyotes, and as severe winter range for deer. CPW uses severe winter range to describe the portion of the range of a species where 90 percent of the individuals are located when the annual snowpack is at its maximum in the two worst winters out of ten (i.e., areas used during severe winters when higher quality habitats are unavailable due to deep and persistent snow).

Sagebrush Shrubland

Two types of sagebrush shrubland in the Planning Area have a combined area of 27,400 acres, of which approximately 22 percent is on BLM land. On top of the plateau, mountain sagebrush occurs on slopes and uplands throughout much of the area, where it shares dominance with other shrubs such as Utah serviceberry and bitterbrush *(Purshia tridentata).* Because of the more mesic conditions at these higher elevations, the sagebrush shrubland above the rim also has a relatively lush and diverse understory of grasses and forbs. Besides increasing the overall diversity of the sagebrush community, the presence of serviceberry (a tall species that provides cover), bitterbrush (a low-growing species favored as winter browse), and relatively lush herbage also make this important summer and transitional range for mule deer and American elk. The higher elevations make this type of sagebrush community available for winter range only during mild (relatively warm and snow-free) winter seasons.

Below the rim, Wyoming big sagebrush (now considered a subspecies of mountain sagebrush) occurs on lower ridges and fans grading between the semi-desert scrub (which includes basin big sagebrush) and pinyon/juniper communities. The lower precipitation and warmer temperatures of these areas support foliage that tends to be underdeveloped compared to higher elevation sagebrush. However, the warmer and more snow-free conditions make the lower elevation sagebrush important as winter range.

Pinyon/Juniper Woodland

This community is extensive throughout the region, where it occupies large areas of transitional habitat at elevations intermediate between river valleys and mountain slopes, including the dissected foothills extending away from the Roan Cliffs. The total area of pinyon/juniper in the Planning Area is 23,590 acres, of which 15,430 acres occur on BLM land. Most of this type is formed on Wasatch shale. As is typical of this type, the pinyon pine and Utah juniper (*Juniperus osteosperma*) are associated with a sparse understory of grasses and forbs, as well as soil-specific subshrubs. The “pygmy conifers” support nesting by a variety of small birds, including several species that nest either primarily or only in this type. Mule deer, elk, predators (including the mountain lion, bobcat, and coyote), and a variety of raptors, small mammals, and reptiles also occur in this habitat. In addition to some shrubs, including sagebrush and mountain-mahogany, for winter forage, the pinyon/juniper habitat also provides hiding cover and thermal cover for deer, both of which are relatively lacking in the sagebrush and semi-desert scrub communities.

Mixed Mountain Shrubland

Throughout the region, mixed communities of tall shrub, such as Gambel’s oak and Utah serviceberry (sometimes with mountain maple [*Acer spicatum*]), dominate transitional areas between more xeric

pinyon/juniper and more mesic aspen-conifer types. Site conditions that support the mountain shrub type are related to suitable substrate (typically less clayey than the more xeric communities) as well as intermediate elevations and exposures. This type occupies 31,770 acres within the Planning Area, of which 17,080 acres are on BLM land. The tall shrubs, occasional conifers (Utah juniper and Douglas-fir), lush herbaceous stratum, and associated shrubs (mountain snowberry, bitterbrush, wax currant [*Ribes cereum*], and chokecherry [*Prunus virginiana*] combine to provide highly palatable forage and ample cover for wintering ungulates and large predators, as well as a compositionally and structurally diverse habitat for small mammals and songbirds. Several species of small birds occur either mostly or entirely within this habitat type. Additionally, the presence of acorns and berries makes this habitat a favorite area for black bear during pre-hibernal hyperphagia (putting on fat for winter).

Aspen Forest

This deciduous tree species is common throughout the Rocky Mountains and on mountain islands of the Colorado Plateau. Mature, in many cases apparently climax, stands of aspen occur across much of the area atop the Roan Plateau, where they form a mosaic with the mountain sagebrush, mixed mountain shrub, and conifer forest types. Of the 11,390 acres of aspen forest within the Planning Area, BLM land accounts for 8,370 acres (73 percent). Aspen forests within the Planning Area, and in general throughout the region, support a rich and lush understory of grasses, forbs, and shrubs. The species is often associated with minor areas of surface water, including seeps and springs, and other areas of slightly elevated moisture associated with persistent snow, cooler aspects, or reduced exposure to wind. The mesic conditions, lush forage, and dense thermal and hiding cover it provides make aspen forest a preferred summer habitat for deer and elk, as well as for black bear and a variety of smaller species. Such habitat is also preferred for deer and elk fawning and calving. The structural complexity offered by the trees also attracts arboreal bird species and provides nesting and hunting habitat for a variety of raptors.

Conifer Forest

The Planning Area contains a total of 6,760 acres of conifer forest, of which 3,530 acres are on BLM land. Douglas-fir, subalpine fir, and Engelmann spruce (*Picea engelmannii*) attract a variety of forest species that do not occur in the other habitat types present. Besides the raptors, small mammals, and small birds attracted to the conifers, the dense forest also provides thermal and hiding cover for large mammals including deer, elk, and black bear. The understory beneath the conifers can be rather sparse in areas of dense growth, but more lush and diverse in more open stands and small clearings. Another type of conifer forest occurs in some areas below the rim, especially in the east-facing portion of the Roan Cliffs and Magpie Gulch. Mature Douglas-fir forest, in some places classified as “old-growth” forest, provides remote, secluded, and mature forest habitat for summer and transitional use by large mammals as well as year-round use by forest birds and small mammals. During hunting season, this rugged terrain provides secure, secluded habitat for big game because the rough terrain and lack of roads makes it all but inaccessible to hunters.

Cliffs and Caves

The Roan Cliffs, while extensive, provide limited habitat for most wildlife species, although some birds nest in niches or ledges, chiefly the white-throated swift and rock wren, but also the cliff-nesting raptors such as peregrine falcon. These niches are also used for roosting and breeding by bats, as are caves.

Low Elevation Riparian/Wetland Communities

Communities of narrowleaf cottonwood, box-elder, associated wetland shrubs (willows, alders, and birches), riparian-margin shrubs (chokecherry, river hawthorn *(Crataegus rivularis)*, and dogwood *(Cornus sericea)*, scattered conifers (blue spruce and Rocky Mountain juniper *(Juniperus scopulorum)*, and herbaceous wetlands (especially cattails *(Typha latifolia)* occur along the Colorado River, Parachute

Creek, and Government Creek. The large trees, tall shrubs, and lush understory provide cover and forage for some resident deer, for migratory deer during winter, and for deer fawning and elk calving in spring. Wild turkeys use the habitat for nesting and wintering (Map 22), and a variety of raptors use the trees for nesting and perching. Bald eagles use them as winter roosts while hunting for waterfowl, fish, and carrion in adjacent habitats. The structural complexity and compositional diversity of the habitat also attracts numerous small birds, small mammals, reptiles, and amphibians. Among these are several species of neotropical migrant songbirds that winter at southerly latitudes, as well as year-round residents and local (elevational) migrants. Smaller, scattered patches of cottonwoods also occur along minor drainages such as Cottonwood and Goodrich creeks.

The lowland riparian woodlands are especially important because they occur in areas that are otherwise hot, dry, and relatively barren, and therefore receive disproportionately high levels of use. This includes species that spend most of their time within the riparian habitat, species that nest in the corridor and feed in adjacent terrain, and species that remain mostly in the nearby terrain but move into the corridor for water, shade, or forage. The trees and dense shrubs also provide seclusion for aquatic species along the river (e.g., water birds) and enhance the aquatic habitat quality compared to unsheltered stream reaches.

High Elevation Riparian/Wetland Communities

Tributary streams atop the plateau support a riparian community typically dominated by wetland shrubs and herbaceous wetland species, with discontinuous areas of aspen and scattered conifers. A small area of cottonwood and box-elder trees occurs along a reach of East Fork Parachute Creek below the falls. Although less densely wooded than the low-elevation cottonwood forests, the high-elevation riparian/wetland communities are nonetheless important because they provide movement corridors, thermal and escape cover, nesting and resting sites, and lush forage. They also enhance aquatic habitat by improving bank stability, provide shade to reduce thermal stress and seclusion along the streams, and serve as a source of insect prey for aquatic species.

Aquatic Habitats

The major aquatic habitats within the Planning Area and vicinity include the Colorado River and smaller streams in the Parachute Creek tributary system, with more limited aquatic habitat along Government Creek. The Colorado River and Parachute Creek are perennial within the Planning Area and support a diverse fish community, including three species of rare (ESA listed) Colorado River fishes, other native non-game fishes, and introduced gamefishes. The smaller tributaries atop the plateau support only two fish species, but one of these species CRCT occurs in two genetic lineages, both of which are regionally important. All of the perennial, intermittent, and ephemeral drainages within the Planning Area offer potential breeding habitat for amphibians and nesting or feeding habitat for water birds, either within the aquatic habitat of the drainage or in riparian/wetland vegetation sustained by periodic surface flows and more protracted subsurface moisture.

Ponds and reservoirs are limited within the Planning Area. Numerous small stockponds provide potential habitat for breeding by amphibians and resting/feeding sites for water birds. A larger impoundment, Fravert Reservoir, is located in the southeastern portion of the area below the cliffs and provides high-quality habitat for feeding and breeding by waterbirds.

3.3.2.3 Current Use by Wildlife

Information on species occurrence, abundance, seasonality, and habitat use of the area surrounding the Planning Area is available in a number of Colorado sourcebooks, including information on fish (Woodling 1984 and 1985), reptiles and amphibians (Hammerson 1999), birds (Andrews and Righter 1992; Kingery 1998), and mammals (Armstrong 1972, Armstrong et al. 2011). In addition to these

sources, information on special-interest species, including hoofed mammals, predators, several species of raptors (birds of prey), federally-listed or State-listed threatened or endangered species, and other sensitive species, is maintained by CPW in a Geographic Information System (GIS) database. This information incorporates data from the CNHP and other sources into the Colorado Natural Diversity Information Source (NDIS) database, available online. NDIS data can be displayed by county, BLM resource area, or other geographic or political unit. Sources of information on wildlife within the Planning Area include a baseline characterization of NOSRs 1 and 3 (TRW 1982), a rare-species inventory of NOSR 3 (CNHP 1998), a sensitive-species monitoring survey (Greystone 1995), and observations by BLM personnel. The 1999 FSEIS and 1984 GSRA RMP describe wildlife resources for the GSRA, which includes the Planning Area.

Big Game Ungulates (Hoofed Mammals)

The Planning Area provides regionally important habitat for two native ungulates: the deer (Map 20) and elk (Map 21). These are the most abundant, widely distributed, intensively managed, and sought-after big game species in Colorado. Consequently, they are of special interest in the region due to their monetary value to CPW and the tourist industry, and their recreational value to hunters. Many tourists and non-consumptive recreationists also place value on seeing deer and elk in conjunction with their travels and outdoor experience.

Deer and elk are managed by CPW through a licensing system for hunting, with annual "harvest" rates in a given area (based on the number of permits issued) adjusted based on population trends and habitat quality and extent. The Planning Area lies almost entirely in Game Management Unit (GMU) 32, with a small portion along the northern edge in GMU 22. The boundaries of GMU 32 include SH 13 on the east, the divide between the Parachute Creek and Roan Creek basins on the west, the Colorado River on the south, and the divide between the Colorado River and Piceance Creek basins on the north. The Planning Area represents 66 percent of the total area of 301 square miles in GMU 32. Approximately 39 percent of GMU 32 is public land, consisting largely of BLM lands within the Planning Area. The parcels of private land are typically large tracts (more than 15,000 acres) acquired by energy companies during exploration and research related to oil shale or, more recently, oil and gas exploration and development.

Deer and elk generally migrate seasonally from summer range at higher elevations to winter range at lower elevations. In some situations, such as specific site conditions and favorable weather years, deer and elk may remain in the same area throughout the year. However, even this is generally combined with smaller scale winter movement to warmer and relatively snowfree aspects, such as on south-, southeast-, or southwest-facing slopes, and to areas with accessible winter forage. Slopes of 15 to 40 percent are generally preferred, and slopes steeper than 75 percent receive little use. Winter range is used from late fall until early spring, with the period of December through April typically the most critical. During mild winters, deer and elk are scattered throughout the winter range and transitional range (i.e., habitats between winter and summer ranges). In severe winters, colder temperatures and deeper, more persistent snow cover may force the animals to areas that are warmer and drier but often provide poor forage.

The availability of winter range is generally considered a limiting factor for big game populations (i.e., a factor that directly and strongly influences numbers in a given area), and in this context is considered by CPW to be "critical" habitat.

Winter range mapped by CPW includes overall winter range, severe winter range (the only available habitat during severe winters), and winter concentration areas that support unusually high population densities. While any loss, degradation, or fragmentation of winter range would be expected to directly affect deer and elk populations, impacts to severe winter range and winter concentration areas would have disproportionately greater consequences. However, the impact analysis in Chapter 4 assumes that all

winter range below the rim is important to the maintenance or recovery of mule deer populations, and that all summer range atop the plateau is important for elk.

Other significant habitats for deer and elk include fawning and calving ("production") areas, security (seclusion) areas (security areas are above the rim and seclusion areas are below the rim; security and seclusion are used interchangeably), and migration routes. Production areas typically consist of habitats that provide the combination of thermal and hiding cover, lush forage, water, and gentle terrain needed during the birthing and early rearing periods. Where such habitats are very limited in an area, CPW often maps specific calving or fawning areas. Elk production areas are mapped in the Planning Area. Security areas provide refuge for animals during the hunting season, such as areas of rugged terrain or deep timber. Migration corridors may include a variety of shapes and types, but within the Planning Area consist of the few points where deer and elk (and other large mammals) are able to find access routes through the otherwise impassable Roan Cliffs. These points are critical for allowing animals to move between summer and winter ranges, as well as to/from security areas.

The following subsections provide more specific information on mule deer and American elk within the Planning Area. Table 3.3.4 provides summary information on deer, elk, and combined winter range within the Planning Area and selected regional GMUs.

Table 3.3.4 Deer and Elk Winter Range in the Planning Area and Surrounding Region [1,2]

Area Analyzed	*Total Area*	*Deer Winter Range [3]*	*Elk Winter Range [3]*	*Combined Total [3]*
Planning Area – Federal	66,780 ac	27,590 ac 41%	22,670 ac 34%	33,770 ac 51%
Planning Area – Private	60,110 ac	30,810 ac 51%	30,840 ac 51%	59,110 ac 98%
GMU 32	192,820 ac	76,580 ac 40%	88,770 ac 46%	113,940 ac 59%
Deer DAU 41 (GMU 31 + 32)	642,410 ac	306,400 ac 48%	227,890 ac 35%	423,800 ac 66%
Elk DAU 10 (GMU 21-22, 30-32)	2,400,580 ac	-- [4]	1,572,800 ac 66%	-- [4]

Notes:
[1] Includes winter range, severe winter range, and winter concentration areas (source: NDIS online database).
[2] Percentages relate the acres of winter range to the total acres in the area analyzed.
[3] Numbers for deer and elk Include area of overlap; combined total does not double count area of overlap.
[4] Data for DAU 10 limited to elk, because deer herds do not range across such a large area.

Key:
ac = acre
DAU = Data Analysis Unit
GMU = Game Management Unit

Mule Deer

Mule deer occur throughout the mountains and valleys of western Colorado. Historically, mule deer populations have fluctuated due to natural factors, such as drought and severe winter weather. Deer populations in the Planning Area and throughout Colorado have reflected this pattern of periodic fluctuations, with a population high in the early 1980s followed by a major decline following the severe winter of 1983-1984 (deep and protracted snow cover and extremely cold temperatures). Deer populations in Data Analysis Unit (DAU) 41 (which includes GMUs 31 and 32) have declined since the 1980s, with

dramatic declines in the early 1990s. Since 1995, CPW's post-hunt population estimates have remained relatively stable, at around 7,000 individuals. CPW's current long-term objective for the mule deer population in DAU 41 is 6,500 to 8,500 individuals. This population objective was revised during the DAU planning process finalized in 2012. This range encompasses the post-hunt deer herd size of 7,600 for 2013.

Habitat loss from landscape-scale changes, including oil and gas development, and long-term drought conditions are considered to be the cause for the decline and failure to rebound. Displacement of deer from native winter ranges to less desirable ranges has probably occurred in response to natural gas development. Mule deer avoid well pads, especially those with high traffic volume (Sawyer et al. 2009). This has the potential to adversely impact survival, reproduction, and recruitment. Another factor affecting deer is competition with elk in DAU 41. The elk herd in DAU 10 that overlaps the DAU 41 deer herd has grown from 4,000 elk in 1980 to 11,810 in 2013, and mirrors the deer herd decline. The landscape may not be able to support the earlier larger herd sizes.

A typical annual pattern in the Planning Area begins with deer moving onto irrigated hay fields and sagebrush flats during green-up in early spring. Irrigated pastures, where available, may receive heavy use due to the much more palatable and nutritious forage than typically present on winter range at the end of the winter season. As green-up of native vegetation progresses to higher elevations, deer follow and arrive atop the plateau during May. Their access to the plateau is focused in one area (Map 20). They remain on the summer range throughout the summer months, during which time they bear and raise their young. Fawning and other summer uses for deer are dispersed across the top of the plateau. Site-specific studies indicate that Gambel's oak and mountain sagebrush communities receive the heaviest use by deer. Stands of quaking aspen or conifers provide ideal hiding and thermal cover for fawns, while streams and springs provide water and lush forage. Bitterbrush, mountain-mahogany, and Utah serviceberry receive preferential use when present due to higher palatability and nutritive value. The selective use of bitterbrush and Utah serviceberry is exhibited by extreme clipping (hedging, pruning) of the branches. These three shrub species are also present in some winter habitats within the Planning Area, although not in the lowest and, therefore, warmest and driest areas.

In late September, deer begin moving off the plateau and onto transitional habitat and winter range in the pinyon/juniper, mountain shrub, and sagebrush zones, including most of the area below the rim (Map20). These areas, including Magpie Gulch, Sharrard Park, and sideslopes along the Parachute Creek valley, provide some of the best remaining winter habitat in GMU 32. Historically, winter use has also included the Colorado River corridor, which provided water, cover, and forage. Access to the river is now largely denied by the intervening barrier of I-70.

The winter diet of mule deer primarily consists of twigs and shoots of the abundant shrubs and what little herbage may be found in moist sites along drainages. Winter is a time of nutritional depletion; deer use much or all of their fat reserves by late winter and are especially vulnerable to the stress of late-season cold snaps, snowfall, delayed green-up due to drought or cold, stress due to disturbance from human activity, and fatigue from being chased by dogs or wild predators.

As shown by the data in Table 3.3.4, approximately 27,590 acres (41 percent of the BLM portion of the Planning Area) is mapped as deer winter range. This includes nearly all of the BLM lands below the rim, with only densely forested slopes of Douglas-fir, areas too steep to support vegetation (including cliffs and talus cones), and severe badlands not supporting this use. Note that a higher percentage of private lands in the Planning Area is mapped as mule deer winter range (i.e., 51 percent). This reflects that larger portions of the private lands are below the cliffs.

The data in Table 3.3.4 show that BLM lands contain 40 percent of the deer winter range in GMU 32 and 48 percent of that in DAU 41. However, the BLM lands represent 34 percent of the total area of GMU 32, and 10 percent of DAU 41. Thus, the BLM lands contain a larger portion of winter range relative to the size of the GMU and DAU.

An important feature of the Planning Area relative to movements and use by mule deer is the barrier to seasonal (elevational) movement posed by the sheer Roan Cliffs. Even sure-footed deer (and elk) are unable to penetrate this barrier except for a few places where breaks in the cliffs provide passages. Only one such area ("migration corridor") occurs within the Planning Area for deer (Map 20).

American Elk

This large ungulate is also prone to natural population cycles and, like the mule deer, reached a population peak in the region in the early 1980s but declined sharply following the severe winter of 1983-1984. However, recovery since that time has been more pronounced, with post-hunt population estimates in DAU 10 (which includes GMUs 21, 22, 30, 31, and 32) increasing steadily from post-hunt estimates of 6,500 animals in 1983, to 8,270 animals in 2005, and 11,810 animals in 2013. The elk herds are above the current long-term objective for elk populations in DAU 10 (established by CPW in 2006) of 7,000 to 9,000 animals. The elk harvest has also been more consistent than for deer. For example, the number of elk harvested in GMU 32 was 140 in 1991, 160 in 2001, and 210 in 2013. This reflects the increasing elk populations and that there is no current need for CPW to develop stricter hunting regulations for this species.

Elk have several competitive advantages over mule deer in areas of sympatry (i.e., geographic overlap). These include the following: (1) larger bodies allow them to withstand colder temperatures, decreasing vulnerability to winter mortality from temperature stress; (2) longer legs enable them move more easily through snow, increasing the area available to them in winter; (3) larger adults are less vulnerable to predators and more able to defend their young; (4) elk are able to consume a wider range of plants, and because grazing (consumption of herbaceous species) is a more important part of their diet, they are better adapted to exploit the grasses and hay species planted by ranchers for livestock forage; (5) elk are behaviorally more flexible, often moving readily onto private property to graze alongside cattle during fall and, thus, avoiding hunters.

Unlike the pattern for deer, most of the elk herd in the Planning Area migrates northward from summer range atop the plateau to winter range along Piceance Creek and Roan Creek. This may reflect a combination of the difficult access routes through the cliffs but is probably more associated with the relative poor quality (for elk) of the dry, grass-impoverished habitats south of the cliffs. Some of the elk that summer in the Planning Area spend winter months on slopes along Parachute Creek and Government Creek near the western and northeastern edges of the Planning Area, respectively (Map 21). This pattern of use results in little competition between deer and elk for the habitats south of the cliffs.

Elk winter range covers 34 percent of the BLM lands and 51 percent of the private lands (Table 3.3.4). The higher proportion of winter range on private lands is related to the prevalence of lower elevation areas and to areas along Parachute Creek that receive substantial use by elk that summer on top of the plateau (Map 21). As noted above, most of the remaining portion of the summering elk population moves northward out of the Planning Area instead of to areas south of the cliffs.

The data in Table 3.3.4 also show that BLM lands consist of a larger proportion of elk winter range than the larger region. BLM lands represent 34 percent of the total area of GMU 32 and 46 percent of the elk winter range. Similarly, the BLM lands represent 10 percent of the total area of DAU 41 and 35 percent of the elk winter range. (Note that deer DAU 41 is used for this comparison rather than elk DAU 10, because DAU 41 is more relevant to the Planning Area).

Summer range is considered critical for elk in DAU 10, due to the limited amount of mesic, high-elevation habitats as compared to most of the more mountainous areas of Colorado. Because much of the region is xeric, particular importance is ascribed to areas of predictable water, patches of aspen and conifers for hiding and thermal cover, and meadows for forage. The high-quality summer range atop the plateau provides an important share of the summer range in these areas. For example, the Federal lands on top of the plateau represent 53 percent of the amount in the Planning Area, 34 percent of the amount in GMU 32, and 10 percent of the amount in DAU 41. In comparison to the entire DAU 10, the total private plus Federal lands in the Planning Area provide more than 3 percent of the total elk summer range and 5 percent of the total land area. More extensive summer range occurs at the generally higher elevations of nearby mountainous portions of the White River National Forest, but these areas are not within DAU 41 and DAU 10.

CPW has mapped specific production areas for elk in the Planning Area. Essentially, a large proportion of the entire top of the plateau is suitable for calving and rearing of young due to the mosaic of aspen and conifers for cover, meadows and sagebrush shrublands for forage, relatively gentle topography, and ample surface water.

Unlike with mule deer, no specific passage points through the steep Roan Cliffs have been mapped (Map 21). Summering elk atop the plateau can move to/from winter range below the cliffs through multiple draws on the east side of the plateau, in mapped wildlife security areas. These draws not only accommodate seasonal vertical migration, but also provide areas where elk can find refuge during the hunting season. Security areas are generally heavily wooded, rugged, and steep, which precludes OHV travel and most other human use. However, as described previously, most of the elk population moves northward to winter ranges in the Piceance Creek and Roan Creek drainage basins, and most of the portion that winters within the Planning Area does so either along Parachute Creek or Government Creek (Map 21).

Large Carnivores

The mountain lion and black bear are the two common large carnivores in Colorado, and both are hunted. Along with deer and elk, they provide a recreational as well as an ecological resource within the Planning Area.

Mountain Lion

Mountain lions typically follow their primary food sources, which, in the Planning Area, include deer, young elk, smaller mammals, and upland gamebirds with the same general elevational pattern as the ungulates. Mountain lions are generally dispersed throughout the summer but may make more intensive use of smaller areas during winter when deer are concentrated on winter range. Populations are cyclical, reflecting cycles in their prey. When big game numbers are low, mountain lions shift to other prey, including domestic livestock. Damage complaints by ranchers about mountain lion predation on domestic sheep are common in the eastern portion of the Planning Area. In 2013-2014, CPW reported a harvest of five lions during 14 recreation days in GMU 32.

Black Bear

This large species, an omnivore in terms of diet, inhabits the top of the Roan Plateau, transitional habitat on rugged slopes, and riparian habitats along major drainages. The more xeric shrub and pinyon/juniper habitats receive little use due to sparse cover and lack of food. Black bears make heavy use of acorn and berry crops in mountain shrub habitats in fall and aspen buds in spring. Throughout the summer, bears feed on a variety of plants and small animals (rodents and ground-nesting songbirds) as well as carrion. Black bears typically seek dens in rocky areas, small caves, or tunnels under tree roots to hibernate. CPW reported a harvest of five black bears during five recreation days in GMU 32 in 2001.

Other Mammals

Small Carnivores

Other predators in the Planning Area include the bobcat, coyote, red fox, American badger, long-tailed weasel, short-tailed weasel, and mink. The coyote occurs throughout the Planning Area, while the similarly sized bobcat is mostly limited to rugged or wooded areas. The red fox, long-tailed weasel, and short-tailed weasel prefer mosaics of wooded and open terrain and are mostly associated with habitats atop the plateau and along the main streams. The American badger occurs in expanses of grassland or sparse, low-growing shrubs. The mink prefers riparian woodlands and is likely to occur along the Colorado River and Parachute Creek. Raccoons, ringtail, striped skunks, and western spotted skunks probably also occur—raccoons and striped skunks mostly along the major drainages and spotted skunks and ringtails in canyons on the margins of the site.

Two special status carnivores that occur in the general region are the Canada lynx, a federally-listed threatened species that was recently reintroduced into Colorado, and the American marten, designated as a sensitive species by USFS. Neither of these species is known to occur in the Planning Area, and potentially suitable subalpine habitat atop the plateau is both limited and isolated. Section 3.3.4 discusses these and other special status species.

Small Mammals

The diverse habitats of the Planning Area support a variety of other mammals. Although of limited recreational or economic importance, these species are important components of the ecosystem. They provide a food source for predators, both actively and passively affect plant communities, and in some cases (e.g., the beaver) can have profound influences on the physical habitat. Their presence also contributes in a large way to the overall biodiversity of the Planning Area.

Lagomorphs (rabbits and hares) documented or likely to occur in the Planning Area include the white-tailed jackrabbit and desert cottontail in semi-desert shrublands and grasslands at lower elevations, and the snowshoe hare *and* mountain cottontail in mixed forest habitats atop the plateau (TRW 1982, Armstrong et al. 2011).

Rodents occurring onsite include the beaver and muskrat along streams, porcupine in woodlands at all elevations, and several sciurids (members of the squirrel family). The latter include: the yellow-bellied marmot on talus slopes and rock outcrops; the red squirrel, golden-mantled ground squirrel, and least chipmunk in mixed forests atop the plateau and along the cliffs; the rock squirrel and Hopi chipmunk in rocky areas and lower elevation woodlands; and the Wyoming ground squirrel and thirteen-lined ground squirrel in open grasslands and sparse shrubs in the upper and lower elevations of the Planning Area, respectively. The white-tailed prairie dog (another regional sciurid) is present in arid grasslands and semi-desert scrub farther west in Colorado but is not known to occur within the Planning Area.

Other rodents observed or expected include the northern pocket gopher in mountain grasslands, western jumping mouse in riparian wetlands, and other widespread species such as the bushy-tailed woodrat (packrat, deer mouse, canyon mouse, pinyon mouse, northern grasshopper mouse, long-tailed vole, and plains pocket mouse. Non-rodent, ground-dwelling, small mammals documented or expected include Preble's shrew (CNHP 1997a) and the masked shrew, montane shrew, dwarf shrew, and water shrew (Armstrong et al. 2011). Several bat species also occur or would be expected. These include four BLM sensitive species (fringed myotis, Yuma myotis, Townsend's big-eared bat, and spotted bat, as described in Section 3.3.4) as well as the California myotis, western small-footed myotis, long-eared myotis, long-legged myotis, little brown myotis, big brown bat*)*, hoary bat, and western pipistrelle (Finley et al. 1983; Armstrong et al., undated). Bats are likely to be associated with wooded areas atop the plateau, along the cliffs, and along major drainages, as well as alcoves, ledges, and caves along the Roan Cliffs.

Birds

Raptors

The avifauna of the Planning Area, including raptors, also reflects the wide range of habitats present and the location in the transitional zone between the Southern Rocky Mountain and Colorado Plateau provinces. The descriptions provided below are arranged by taxonomic and trophic groups.

Raptors that are known to occur or potentially present in the Planning Area include two species of eagles, three species of falcons, several species of hawks and owls, and the turkey vulture. Specific use areas for specific raptors are shown on Map 22. Four of these species (the peregrine falcon, bald eagle, ferruginous hawk, and northern goshawk) are BLM sensitive species. Apparently, suitable habitat for another raptor ESA listed as threatened, the Mexican spotted owl, is also present in wooded canyons of the Planning Area, but the known geographic range of this species does not include Garfield County. Special status species are discussed in Section 3.3.4.

Other raptors known to occur in the Planning Area, or potentially present based on location and available habitats, include: golden eagles and prairie falcons nesting along the Roan Cliffs and hunting in open terrain; great horned owls, red-tailed hawks, and potentially Swainson's hawks nesting along cliffs and forest edges or open woodlands; flammulated owls, western screech-owls, Cooper's hawks, and sharp-shinned hawks in medium-density woodlands and riparian forests; northern saw-whet owls, northern pygmy-owls, and boreal owls in higher elevation aspen and conifer forests (along with northern goshawks); and northern harriers in open grassland, sagebrush, or agricultural habitats. Turkey vultures are seen throughout the Planning Area and probably nest in wooded terrain below the cliffs.

Gallinaceous Birds

Upland fowl (upland gamebirds) within the Planning Area include the chukar, dusky grouse, and wild turkey. Another galliform, the greater sage-grouse, is known to occur west and north of the Planning Area with some limited presence in the Planning Area. It is probable that this species historically occurred in sagebrush habitats atop the plateau and below the cliffs. The BLM and the USFS have prepared the NWCOGSG FEIS (BLM2015d) to define management plans for this species. This species and another BLM sensitive species, the Columbian sharp-tailed grouse, are discussed in Section 3.3.4.

The chukar, a non-native gamebird, occurs in small populations on steep slopes and talus areas in xeric canyons, especially Wheeler Gulch northeast of Parachute. The ephemeral drainage on the floor of the gulch provides water and nesting sites. The dusky grouse occurs in aspen/conifer forests and mixed mountain shrubs atop the plateau. The wild turkey is the most important of the gallinaceous species onsite as a gamebird. Turkeys use riparian habitats and nearby mountain shrub and pinyon/juniper habitats for nesting and wintering. The two main production (nesting and brood rearing) areas for wild turkeys are along Parachute Creek and Government Creek (Map 22). Mountain shrub habitats that contain oakbrush are critical during fall and winter, when the acorn crop is a major food source.

Waterbirds

Waterfowl, wading birds, and shorebirds in the Planning Area are limited by the minimal amount of aquatic habitat. The areas of greatest use by waterbirds are the Colorado River, Parachute Creek, Government Creek, perennial portions of tributaries to these streams, and Fravert Reservoir. Common waterfowl (ducks, geese, and allies) on the major streams and impoundments include: Canada goose; common merganser; puddle ducks, such as the mallard, gadwall, American wigeon, blue-winged teal, and green-winged teal; and diving ducks, such as the common golden-eye, lesser scaup, ring-necked duck, redhead, and canvasback. The mallard, blue-winged teal, and green-winged teal are the most common species on smaller streams and ponds atop the plateau

The most common wading bird in the area is the great blue heron, which nests in mature cottonwoods along the Colorado River and main tributaries and may fly considerable distances to hunt for fish in the shallows of streams and ponds. Another wading bird, the white-faced ibis (a special status species discussed in Section 3.3.4), also occurs in the area, primarily along the shallow edges of the Colorado River, the shoreline of Fravert Reservoir, and similar areas. The two most common shorebirds in the Planning Area are the spotted sandpiper, which may nest along portions of Parachute Creek, Government Creek, and higher elevation tributaries, and the killdeer, a ground-dwelling shorebird often associated with barren areas around stockponds and on gravel flats along rivers. Other wading birds and shorebirds use the Colorado River and tributaries during migration.

Small Birds

Perching birds (songbirds and flycatchers), woodpeckers, and other small bird species documented or expected in the Planning Area also reflect the wide range of habitats present. The following listing of species likely to breed onsite does not include all potential species. Many of the species listed for aspen/conifer forest may occur in lower elevation habitats during winter. The listing is organized by major portion of the Planning Area or habitat type in which the species is most commonly found.

- **Semi-Desert Scrub and Sagebrush Shrubland** – Western kingbird, eastern kingbird, horned lark, western meadowlark, sage thrasher, Brewer's sparrow, vesper sparrow, and lark sparrow.

- **Pinyon/Juniper Woodland** – Common poorwill, Say's phoebe, gray flycatcher, ash-throated flycatcher, pinyon jay, violet-green swallow, juniper titmouse, common bushtit, Bewick's wren, blue-gray gnatcatcher, western bluebird, mountain bluebird, Northern mockingbird, loggerhead shrike, plumbeous vireo, gray vireo, black-throated gray warbler, and house finch. Clark's nutcracker occurs as nomadic individuals during years with heavy pinyon-nut production.

- **Mountain Shrubs** – Dusky flycatcher, western scrub-jay, MacGillivray's warbler, Virginia's warbler, spotted towhee, and green-tailed towhee. The band-tailed pigeon occurs as nomadic flocks during years of heavy acorn production.

- **Riparian Forest** – Northern flicker, red-naped sapsucker, downy woodpecker, Cordilleran flycatcher, willow flycatcher, black-billed magpie, purple martin, house wren, black-capped chickadee, gray catbird, American robin, Swainson's thrush, veery, Bullock's oriole, warbling vireo, yellow warbler, orange-crowned warbler, yellow-breasted chat, fox sparrow, lazuli bunting, American goldfinch, and lesser goldfinch.

- **Aspen/Conifer Forest** – Broad-tailed hummingbird, northern flicker, American three-toed woodpecker, hairy woodpecker, Williamson's sapsucker, red-naped sapsucker, western wood-pewee, olive-sided flycatcher, Hammond's flycatcher, Steller's jay, violet-green swallow, tree swallow, American robin, Townsend's solitaire, hermit thrush, mountain bluebird, house wren, mountain chickadee, white-breasted nuthatch, red-breasted nuthatch, brown creeper, warbling vireo, yellow-rumped warbler, western tanager, chipping sparrow, dark-eyed junco, pine siskin, Cassin's finch, and evening grosbeak.

Other species include the white-throated swift and rock wren around rock outcrops and cliffs; the belted kingfisher, northern rough-winged swallow, bank swallow, barn swallow, and cliff swallow along low-elevation streams; and the common nighthawk, American crow, common raven, Brewer's blackbird, and brown-headed cowbird throughout.

Reptiles and Amphibians

As throughout most mountainous portions of Colorado, the herpetofauna of the Planning Area is somewhat depauperate, owing to relatively high elevations and associated cool summer temperatures and long, cold winters. In general, however, the Planning Area is more diverse than many comparably sized areas due to the wide elevational range and diversity of habitats. Amphibian species known to occur include: tiger salamander in stockponds and other small reservoirs; northern chorus frog in seasonal wetlands atop the plateau; and Woodhouse's toad, and northern leopard frog (the latter two BLM sensitive species discussed in Section 3.3.4) in the vicinity of Parachute Creek. The boreal toad, listed by the BLM as a sensitive species and by CPW as endangered in Colorado (see Section 3.3.4), occurs in wetlands, abandoned stream meanders, and beaver ponds throughout the subalpine zone of Colorado. However, it is not documented to occur near the Planning Area (Hammerson 1999), probably due to extreme isolation of the limited subalpine habitat atop the plateau.

Lizards known or likely to occur include: the short-horned lizard in semi-desert grassland and shrubland north of I-70; the collared lizard, sagebrush lizard, plateau (fence) lizard, tree lizard, and side-blotched lizard in rocky areas of pinyon/juniper and cliffs; and the western whiptail and plateau striped whiptail in river bottoms.

Snakes in the Planning Area and vicinity include: the smooth green snake, and western terrestrial garter snake along streams (the last being found above as well as below the rim); and the striped whipsnake, yellow-bellied racer, and bullsnake in most of the area below the cliffs. All of these are rather common in their ranges. The only pit viper (rattlesnake) known to occur in the Planning Area is the western rattlesnake, found in all habitats below the rim except riparian habitats. The midget faded rattlesnake, listed as a BLM sensitive species and a species of special concern in Colorado (see Section 3.3.4), is currently classified as a subspecies of the western rattlesnake.

Fish

The Planning Area and vicinity support several special status fish species, including genetically pure populations of the CRCT (both Blue Lineage and Green Lineage) atop the plateau and five species of non-game large-river fishes in the Colorado River near and downstream from the site. These are discussed in Section 3.3.4.

Other fishes native to the Colorado River system that are known or expected to occur in the Planning Area or vicinity include the speckled dace and mottled sculpin. These species are the focal species for management in the Colorado River and lower Parachute Creek within the Planning Area and nonnative fish are being removed from the Colorado River by CPW in order to improve conditions for these native fishes. Other species that are native to Colorado, but not the Colorado River system, are also known to occur in area streams. These include the fathead minnow, red shiner, sand shiner, white sucker, and longnose sucker. Non-native gamefish species in area streams include the green sunfish, brook trout, brown trout, rainbow trout, and non-native subspecies of the cutthroat trout. Brook trout occur in the East Fork Parachute Creek watershed (East Fork Parachute Creek, First Anvil Creek, JQS Gulch, Second Anvil Creek) above the falls as well as below the falls for some distance in East Fork Parachute Creek as well as the upper portions of Parachute Creek. Brown trout are found in East Middle Fork Parachute Creek below the falls, in East Fork Parachute Creek below the falls and in mainstream Parachute Creek in the upper portions. Brown trout and rainbow trout are also in limited numbers in the Colorado River in the planning area but in smaller numbers than upstream of the planning area. It is possible that a few nonnative cutthroat trout reside in the Colorado River but in very small (insignificant) number at best. Other species in lower Parachute Creek in incidental numbers or species not actively managed for or desired include white sucker, red shiner, fathead minnow, common carp, green sunfish, and creek chub. In the Colorado River, in low numbers, undesired species include longnose sucker, white sucker, sucker

hybrids, green sunfish, smallmouth bass, largemouth bass, northern pike, black bullhead, common carp, bluegill, black crappie, and yellow perch; these species occur incidentally, but are not desired species

One of the non-natives, the brook trout is mostly a fish of small streams and was introduced to the East Fork Parachute Creek drainage sometime during the early 1970s. An electrofishing survey in 1980 indicated a dense population of brook trout in the East Fork drainage, but none were present in the East Middle Fork (Trapper/Northwater) drainage, indicating that other introductions of this species did not occur or failed. Proliferation of brook trout, when introduced into small mountain streams, is a common situation in the region. This species, being a type of char, spawns in fall rather than spring as do true trout such as the CRCT. The resultant "head start" for a given reproduction class gives the young brook trout an advantage over young cutthroat trout when competing for food during the following summer growth season. Another non-native gamefish, the rainbow trout, is reported to have been introduced into Northwater Creek at least once (Behnke 1979), but the lack of subsequent observations (including the electrofishing survey a year later) indicates that the species did not become established. The presence of non-native gamefish in streams currently or potentially supporting CRCT is considered by the BLM and CPW to be undesirable, and future management may include steps to eradicate the non-native species

3.3.2.4 Current Condition and Trends

The quality and availability of suitable habitats in the Planning Area reflect both the natural physical and biotic environments of the site and the influence of human presence and land uses. Areas below the cliffs have been subjected to prolonged agriculture, primarily grazing of cattle, oil shale exploration and limited development, more recent oil and gas exploration and development, and increasing use by destination recreationists and residents of nearby communities. Areas above the rim have also been subjected to most of these uses, although the remoteness of the area and the lack of significant oil and gas exploration to date have resulted in fewer impacts overall.

Historic and recent uses of the Planning Area have contributed to the creation of a network of roads and smaller routes with a combined length of 347 miles. These roads have resulted in approximately 10,000 acres of direct habitat loss, fragmented formerly unbroken habitats, created zones of disturbance associated with motorized travel, and allowed human access into otherwise inaccessible areas. In the 1970s, the construction of I-70 and a parallel 8-foot-high game fence to reduce vehicle-wildlife collisions, created a major barrier to historic cross-valley movement by deer, elk, and other large mammals.

Land Health Assessments

Lands Atop the Plateau

Grazing allotments in portions of the Planning Area were assessed for land health in the Roan Cliffs Landscape Unit (BLM 2001d), Rifle Creek Landscape Unit (BLM 2002b), and Rifle-West Landscape Unit (BLM 2005b). These assessments concluded that, overall, these lands were meeting Land Health Standards. In 2013, a partial assessment was conducted by the BLM CRVFO on the riparian areas atop the plateau. This was precipitated by the development of this SEIS and the apparent decline in the condition of the riparian areas and the adjacent uplands, as determined from the allotment monitoring and grazing use supervision. Twenty-four streams totaling approximately 55.3 miles on the Roan Plateau were assessed for riparian functioning condition (BLM 2014g). The condition of the ridgetops and side slopes had not changed significantly and was not re-assessed. The results of the assessments are described in detail in the appropriate resource sections. Synopses for individual standards are as follows:

- **Standard #1 (Upland Soils)** – This standard was being met in 1999 at all of the sites assessed. Some areas across the Rifle-West watershed exhibited accelerated soil erosion. In 2013, upland terraces adjacent to Non-Functional or FAR streams exhibited moderate or moderate-to-extreme erosion were

considered degraded due mostly to heavy livestock use. Eight percent of CRVFO lands and 1 percent of WRRA lands did not meet the standard.

- **Standard #2 (Riparian Systems)** – In 1999, this standard was continuing to be met, as PFC at all sites rated as PFC during the previous Land Health Assessment in 1994 (BLM 2001d), and all but one of the sites rated as FAR during the previous assessment were showing an upward trend. The exception to the upward trend for riparian areas rated as FAR in 1994 was JQS Gulch through JQS Pasture, which continued to be rated FAR based on impacts from concentrated use by livestock. The 2013 assessment revealed that, of the 55.3 miles assessed, 42.9 miles of streams achieved or were making progress toward achieving the standard for PFC and 12.4 miles were not achieving the PFC standard. Streams in the upper and broader portions of the watershed, where the impacts were noted, had early seral vegetation with insufficient cover of deep-rooted riparian plants to hold banks, high levels of bank alteration, high width/depth rations, and some raw banks due to blown-out beaver dams (BLM 2014g).

- **Standard #3 (Healthy Productive Plant and Animal Communities of Native and Other Desirable Species)** – This standard was also being generally met in 1999. Plant communities were in good to excellent condition. Weeds were identified as a problem in some areas, especially along riparian areas due to concentrated livestock use. Another issue identified in the 1999 Land Health Assessment above the rim was that many stands of aspen forest were becoming decadent and lacked age-class diversity. While deer and elk would benefit from returning some aspen to a younger stage, and while these species are recreationally important, they are more abundant and widespread in the Planning Area and the region than are several species of forest-dwelling raptors and small birds that would be adversely affected by loss of trees. The 2013 assessment found that approximately 92 percent of upland areas atop the plateau met the standard. The areas not meeting the standard had reduced desirable vegetative cover, increased bare ground, and noxious weeds. Causal factors are grazing and lack of fire or other disturbance.

  Streams atop the plateau were also found to be generally healthy in the 1999 Land Health Assessment and were reported to support productive and healthy fish populations in reaches with adequate year-round flows. However, Standard #3 was not being met relative to the CRCT in JQS Gulch or East Fork Parachute Creek due to an inability to compete with non-native brook trout stocked in headwater beaver ponds in 1971 (Behnke and Zarn 1976) (see Section 3.3.2.3). Measures to reduce or eliminate the brook trout were discussed in the Land Health Assessment report (BLM 2001d) and actions were initiated in 2014. In 2013, 14.2 miles met the standard for aquatic species, 2.1 miles did not meet the standard, and 5.4 miles were limited by flow and volume. Management of CRCT in the Planning Area is addressed in Chapter 2 and 4.

- **Standard #4 (Special Status Species and their Habitats)** – This standard was mostly being met in 1999, except for the decline of CRCT populations in JQS Gulch and East Fork Parachute Creek (see above). The 2013 assessment revealed that 9 percent of the CRVFO managed portion of the Roan Plateau is not meeting this standard for greater sage-grouse, due to livestock grazing, weeds, and, to a lesser degree, fences.

- **Standard #5 (Water Quality)** – This standard was being met for all streams sampled as part of the 1999 Land Health Assessment. This is based on water quality criteria being met for the particular existing or potential water use classes assigned to each stream by the State of Colorado (Colorado Water Quality Control Commission [CWQCC]). These include Aquatic Life Cold Water 1 and 2, Recreation 2 (includes fishing), Water Supply (potable, standard treatment but not necessarily a water supply), and Agriculture (irrigation and stock watering). In 2013, within the Roan Cliffs assessment area, 48.6 miles were meeting the standard with problems.

Lands Below the Rim

BLM conducted a Land Health Assessment on a portion of the lands below the rim, from Hubbard Mesa to the north (see BLM 2002b). While not specifically listing the different standards, as in the 1999 assessment for the area above the rim, the 2002 assessment addressed Standard #2 (Riparian Systems) and Standard #3 (Plant and Animal Communities) as follows:

Riparian areas were generally in good condition. Portions of Government Creek are in less than desirable condition due to OHV use within the stream channel, and limited water supply.

Much of the lower elevation lands are not in good condition. Sagebrush is old, decadent, and unproductive. Decades of fire suppression have allowed pinyon and juniper trees to encroach into sagebrush parks. Sagebrush density is increasing and herbaceous cover is declining. In many of these lower elevation areas, sagebrush, mountain mahogany, and serviceberry are severely hedged. In some areas, cheatgrass has become dominant or poses a significant threat of invasion. OHV use in some areas has severely fragmented habitats and resulted in increased erosion, weeds, trash, soil compaction, and loss of vegetation.

An assessment of the Rifle-West Landscape Unit included lands below the rim to the west in 2004 (BLM 2005b). Conditions noted for this landscape include habitat loss and fragmentation associated with oil and gas development, abundant cheatgrass in some areas, sagebrush parks becoming decadent and being invaded by pinyon/juniper, and a very poor herbaceous understory in the semi-desert scrub communities at the lowest elevations of the Planning Area. Very few riparian areas exist in this part of the Planning Area, although conditions appear to be good, given the potential of these small drainages, with the exception of some soil erosion into Cottonwood Gulch where maintenance activities along adjacent roads have pushed soil into the channel.

Habitat below the rim has been mapped by BLM from an ecological perspective using four criteria: High-Value Habitat, Moderate-Value Habitat, Lesser-Value Habitat, and Security areas. These are described in the 1999 FSEIS.

Resource Capabilities

Several trends have direct or indirect effects on wildlife resource capabilities, both regionally and locally. These trends, which include existing types of use and recent or current management, are summarized below.

Habitat Loss and Alteration

The natural environment of the Planning Area and region has been altered and fragmented by construction of roads, oil and gas pads, utility corridors, rural subdivisions, and individual home sites. Disturbance associated with increased human activity and operation of motorized vehicles has further decreased the amount of available habitat as a result of wildlife avoidance of areas with intolerable levels of disturbance. Even in situations where wildlife continue to use a critical habitat subject to disturbance, such as when it is the only habitat available, increased stress can affect survivorship of the population.

While some “edge species” and “generalists” may actually benefit from habitat fragmentation, other “habitat-interior species” and “specialists” may be adversely affected by fragmentation to a degree that exceeds the amount of habitat loss, *per se*. Edge species and generalists include such common wildlife as the mule deer, American elk, coyote, red fox, American robin, and black-billed magpie. Habitat interior and specialist species include the American marten, northern goshawk, and most of the small mammals and songbirds associated with specific plant communities.

Since I-70 was constructed in the 1970s, big game populations in the Planning Area have been largely isolated from habitats along and south of the Colorado River valley. This has forced changes in historical patterns of seasonal use and movement. The barrier created by I-70 is exacerbated by the presence of an 8-foot-high fence constructed to reduce wildlife mortality (and risk to humans) from collisions with vehicles.

As of 1999, oil and gas development had directly affected approximately 1,800 acres of habitat, but the associated traffic and other intrusions had indirectly affected more than 10,000 acres (BLM 1999a). The overall number and density of wells continues to grow. The result is more forage loss and increased habitat disturbance in previously undisturbed areas. As a result, the importance of habitats that have not yet been impacted has increased. Construction and daily management activity also causes time-specific disturbances that are especially detrimental to wildlife in critical habitats or during critical time periods.

Loss of vegetation cover deprives wildlife of direct and indirect sources of food and of sites for hiding, resting, and breeding. Vegetation loss also results in increased runoff (amount and speed), which increases erosion and subsequent downstream sedimentation, leading to downcutting and the resultant loss of riparian habitat, decreased water quality, and reduced stream productivity. Much of the Planning Area is composed of fragile soils and steep slopes that are difficult to reclaim, ranging from long-term impacts (>2 years) to essentially permanent impacts (>50 years) in areas of vegetation removal.

Fire Suppression and Habitat Condition

Fire suppression throughout the region has allowed many plant communities to move into late-seral condition, resulting in over-mature and decadent stands of vegetation. These stands are typically less productive as wildlife habitat. Most notably affected are the semi-desert shrub, scrub, sagebrush, mountain shrub, and pinyon/juniper habitat types. On top of the plateau, the role of long-term plant succession and changes in plant communities are less obvious and the effect on deer and elk forage quality is not as clear. Animal condition, reproduction, growth rate, and survival are all potentially affected.

Riparian Vegetation Condition

Riparian vegetation is critical to many wildlife populations and has generally been affected by disturbance associated with excessive livestock use, intensive recreational use, changes in flow regimes and groundwater tables, and road or pipeline crossings. Restoring riparian structure and function is possible given the availability of water and refrain from grazing or other disturbances. Fencing of portions of the stream and riparian habitat along Trapper Creek is having a positive effect on fish and wildlife habitat. For example, electrofishing of Trapper Creek by the BLM in August 2002 yielded a total of 42 CRCT in a 0.5-mile reach within a grazing exclosure, but only six fish in a 1-mile reach outside the exclosure. This result is especially dramatic given that the unfenced, low-yield reach was downstream from the exclosure and had consistently higher flows. Compared to the exclosure, the unprotected reach was characterized by unstable banks, sparse vegetation cover, and a wider, shallower condition.

Weeds

Noxious weeds are spreading rapidly in the Planning Area and region, lowering overall site condition and quality (see Section 3.3.1). Weeds displace native plants, provide poorer forage and cover for wildlife, and are generally less attractive than native grasses and wildflowers. Weeds are particularly common along roads, drainages, and other areas of concentrated livestock use (e.g., near salt licks and stockponds).

Recreational OHV Use

Recreational use of public and private lands continues to increase. Of greatest concern is OHV use, especially cross-country use by all-terrain vehicles (ATVs). This has resulted in a loss of seclusion, increased wildlife harassment, soil disturbance, creation of additional trails, and loss of vegetation or microbiotic (cryptogamic) crusts.

Hunting

Private land has historically blocked access to large parcels of public land. In some areas, this makes control of big game populations more difficult and increases game damage to other private lands in the vicinity. The Planning Area provides the largest block of land available to the public within GMU 32. With the proliferation of roads and trails and increased popularity of ATVs, the increased noise and frequency of encounters with humans may be moving some species off the top of the plateau and into steeper, more rugged terrain that provides seclusion from hunters but also offers lower quality habitat.

Grazing

Livestock grazing has affected some stream segments by decreasing plant cover and diversity in the adjacent riparian habitat, increasing the potential for sediment transport into streams, making banks more susceptible to erosion, creating conditions favorable for invasion by weeds, and impeding natural succession by the selective consumption of young shrubs or trees that would otherwise become established. Winter livestock grazing still occurs in some areas that provide winter range for deer, resulting in direct competition for forage and space.

Not all livestock grazing is detrimental to big game. The removal of old growth on perennial grasses and forbs can improve the palatability and availability of new growth the following spring and summer. The shape and vigor of shrubs can also be enhanced by proper levels of livestock grazing. The most critical factors are managing the timing, duration, and intensity of grazing to ensure vigor and reproduction of desirable plant species and not creating conditions for invasion by weeds or other undesirable species.

While grazing is often assessed in relation to deer and elk, which compete with cattle and sheep for forage, livestock can have more profound effects on less wide-ranging wildlife, such as small mammals and reptiles, on habitat-specific species, such as many types of songbirds, and on aquatic or semi-aquatic species, such as fish and amphibians. These impacts either occur directly or indirectly from excessive consumption or trampling of vegetation, with resultant decreases in plant cover, forage quantity and quality, soil stability, and bank stability. Water quality can also be affected due to destruction of riparian vegetation, disturbance of the substrate, and contribution of organic matter from feces.

3.3.2.5 Current Management and Desired Future Conditions

Management Plans and Documents

The terrestrial habitat management objective in the 1984 GSRA RMP is “to provide approximately 57,933 animal unit months (AUMs) of big game forage (the amount needed to meet CPW big game population goals in 1988), to improve existing wildlife habitat conditions, and to increase wildlife species diversity.” An AUM consists of one animal unit (an adult female and one young) for one month.

The aquatic habitat management objective for the GSRA RMP for public lands below the rim is “to increase fish production and recreational fishing use on streams having more than 0.5 mile of continuous flow across public land and on lakes surrounded by at least 40 acres of public land. Only streams and lakes with existing or easily obtainable public access and either an existing or potential fishery qualify for management.” The Colorado River is the only stream below the rim that meets these criteria.

Big game management objectives in the 1997 WRRA RMP are to "(1) ensure that big game habitats provide components and conditions necessary to sustain big game populations at levels commensurate with multiple-use objectives and [CPW's] population objectives; (2) maintain or enhance the productivity and quality of preferred forages on all big game range; (3) provide the forms, distribution, and extent of vegetation cover and forage [to] satisfy the physiological and behavioral requirements of big game and encourage efficient use of available forage supplies; and (4) reduce the duration, extent, and intensity of manageable forms of animal harassment during critical timeframes, and avoidance-induced disuse of suitable habitats considered limited in supply and/or critical in fulfilling special functions."

The management objective for raptors (birds of prey) in the 1997 WRRA RMP is to "maintain the short-term utility and promote the continued long-term development and availability of suitable raptor habitats…[including] prey base, nest sites, and other special habitat features necessary to help stabilize or allow increases in regional raptor populations."

The management objective for grouse in the WRRA is to "restore, maintain, or enhance habitat conditions and features conducive to the maintenance or expansion of native grouse populations [and] reduce disruption of important seasonal use activities associated with production and recruitment."

The fisheries management objectives for the WRRA are to "(1) promote improvement and recovery of current, historic, and potential stream fisheries to help increase populations of sport and native fishes; (2) develop and maintain facilities capable of supporting warm-water fisheries; and (3) [provide] increased recreational fishing opportunities within the Resource Area."

The Range-wide Conservation Assessment and Agreement and Strategy for CRCT outlines management of cutthroat trout atop the Plateau; Second Anvil Creek, Parachute Creek, Northwater Creek, and Trapper Creek. This supplemental plan was needed to increase the quantity and quality of CRCT habitat and provide a recreational fishery.

DOE's operational management plan (OMP) for NOSRs 1 and 3 specified the following wildlife management objectives: "(1) [allow] hunting and fishing … only to the extent that they do not interfere with DOE programs or DOE custodial management objectives, and (2) [maintain] cooperation … with [USFWS and CPW], as appropriate, to control and protect wildlife, and to prevent or minimize wildlife damage to other resources."

Management Direction

The wildlife and fisheries management direction for the Planning Area must meet or exceed the upland vegetation Land Health Standard (#3):

"Healthy productive plant and animal communities of native and other desirable species are maintained at viable population levels commensurate with the species' and habitats' potential. Plants and animals at both the community and population level are productive, resilient, diverse, vigorous, and able to reproduce and sustain natural fluctuations, and ecological processes."

For NOSR 1 atop the Roan Plateau, decisions on stipulations to be applied were deferred to this Planning Area land use planning process. Fish and wildlife standards in the remaining GSFO portion of the Planning Area (below the rim) are met through the application of the measures identified in the 1999 FSEIS. These stipulations, developed to help meet the management objectives for sensitive species and, in some cases, comply with Federal laws, include NSO and Timing Limitation (TL) stipulations to protect fish and wildlife resources, as listed below:

- **NSO for Colorado River Corridor** – Establish a 0.5-mile protective buffer along either side of the Colorado River;
- **NSO and TL for Raptor Nesting Areas** – Avoid a 0.125-mile buffer around nest sites year-round, and avoid a 0.25-mile seasonal buffer around active nests from February 1 through August 15;
- **NSO for Wildlife Seclusion Areas** – Avoid areas that provide important security for wildlife, especially deer and elk, in high-value habitats along and below the base of the Roan Cliffs;
- **TL for Big Game Winter Range** – Ensure continued use of winter habitat for big game by avoiding construction activities (including oil and gas drilling, road construction, and other major sources of disturbance) from December 1 through April 30; and
- **TL for Waterfowl and Shorebird Nesting Areas** – Avoid a 0.25-mile seasonal buffer around the nesting and production (brood-rearing) area of Fravert Reservoir from April 15 to July 15.

Additional NSO, CSU, and TL stipulations apply specifically to special status wildlife (see Section 3.3.4), but also provide benefits to other wildlife. These include an NSO and TL for bald eagle nesting and roosting areas, an NSO and TL for the peregrine falcon cliff-nesting complex, an NSO for threatened or endangered species, and a CSU for BLM sensitive species. Some stipulations aimed at protecting vegetation resources also benefit wildlife (i.e., an NSO and a CSU for riparian/wetland vegetation and buffer zone, respectively). Several other restrictions related to vegetation, such as limitations on livestock in certain sensitive communities that are within specified distances of rare plant populations (see Section 3.3.3), will also benefit wildlife by enhancing the density, quality, and production of vegetation cover.

For the portion of the Planning Area within the WRRA, specific wildlife-related use restrictions include an NSO and TL for raptors, TLs for elk production areas (none mapped within the Planning Area by CPW) and deer/elk winter range, and a CSU for the CRCT. Big game forage allocations in the WRRA remain the same as specified in the 1981 Grazing Management EIS and subsequent Rangeland Program Summary (BLM 2002a). Rangelands and grazable woodlands with a downward trend in quality would be reevaluated for forage reallocations. Developing water sources, vegetation manipulations, and animal redistribution techniques are normally integrated with range improvement or riparian restoration activities. Monitoring is conducted to determine which rangelands are healthy, at risk, or not functioning properly. Existing information on raptor nest locations is verified, and supplemental surveys are conducted on a project-specific basis. Protective stipulations and conditions of approval, determined through the NEPA process, are applied as appropriate. Habitat conditions for grouse populations are being restored, maintained, and enhanced. Habitat management guidelines for grouse are also applied during the NEPA process. Fisheries are improved, recovered, and maintained to increase fishing opportunities. Impacts by projects and authorizations are assessed during the NEPA process, with appropriate mitigation applied.

CPW sets population and management goals for both game and non-game species and manages game species through hunting and fishing licenses and regulations. The BLM collaborates with CPW in helping to meet these goals by providing an appropriate amount and quality of habitat on public land, consistent with multiple-use management. State big game management objectives are set through a public involvement process, with final decisions set by the Colorado Wildlife Commission. Current management focus is on protecting critical habitats and improving habitat condition. Over the years, the BLM has implemented site-specific projects to improve habitat conditions for wildlife, utilizing such management tools as prescribed fires and upland water developments.

As noted above, CPW's long-term management plan for DAU 41, which includes GMUs 31 and 32 and encompasses nearly all of the Planning Area, is for 6,500 to 8,500 deer based on the current amount and quality of habitat. The post-hunt population in 2013 was 7,600 individuals, indicating that current population numbers meet the objective set in 2012.

In contrast, the post-hunt population estimate for elk in DAU 10 (which includes GMU 32) in 2013 was 11,810 elk, well above the upper end of the population objective of 7,000 to 9,000 individuals.

Future Management

Future management will focus on maintaining or improving areas rated as PFC in the 1999 Land Health Assessment and on restoring FAR areas to PFC. The two major needs are to:

1. Continue to improve riparian and aquatic habitat atop the plateau, particularly in stream reaches that provide sufficient flows to support CRCT, or upstream reaches that may affect habitat in the occupied reaches. Measures may include continued reductions in the number and duration of livestock grazing, construction of more fences to exclude livestock (coupled in some areas with development of alternative watering sources), and weed management and revegetation in severely affected areas; and

2. Continue to work with CPW to develop and implement a strategy for reducing or eliminating non-native brook trout from streams atop the plateau, some of which have shown serious declines in regionally important and genetically pure populations of CRCT.

These measures would be combined with the protective stipulations described above. Other management opportunities identified by BLM (2002b) include increasing turkey populations, increasing the amount and productivity of wildlife winter range, using prescribed burns to improve some decadent habitats, controlling or eliminating cross-country OHV use, and maintaining largely natural conditions.

3.3.3 Special Status Plants and Significant Plant Communities

Information describing the Affected Environment for special status plants and significant plant communities is carried forward from the Roan FEIS. New information and data includes updated Planning Area spatial data; updated species occurrence data; updated listing status changes; integration of designated Critical Habitat; and revised BLM handbook and manual management direction.

3.3.3.1 Introduction

The BLM is directed to ensure that no action that requires Federal approval should contribute to the need to list a species as threatened or endangered under the Endangered Species Act (ESA). The same protection also applies to species that are proposed or candidates for listing and to species designated by each State Director as sensitive. BLM Manual 6840 (2008b) provides the BLM with sensitive species criteria, policy, and guidance for the conservation of special status species of plants and animals and the ecosystems upon which they depend. The manual directs that "conservation of special status species means the use of all methods and procedures which are necessary to improve the condition of special status species and their habitats to a point where their special status recognition is no longer warranted."

A number of surveys for rare or sensitive plants and significant plant communities have been conducted within the Planning Area (TRW 1981; BLM 1991 and 2014d; CNHP 1997a and 2001). A list of species considered for inclusion in this analysis was compiled from these studies (Table 3.3.5). Species that are known to occur, or highly likely to occur within the Planning Area based on habitat considerations and considered rare, are included in the analysis of impacts and are referred to as special status species in this RMPA/SEIS. Botanical nomenclature follows current CNHP lists.

Significant plant communities within the Planning Area are listed in Table 3.3.6. These include communities that are (1) globally rare, (2) rare within Colorado, or (3) substantially unaltered by human activity. The first two categories include plant communities in which the individual species may not be rare, but the particular combination of species is rare or uncommon. The third category includes native plant communities that are relatively undisturbed and contain few non-native species.

Known locations of special status plant species and significant plant communities are shown on Map 23, created using spatial data collected by the CNHP. Additional known occurrences were located from recorded coordinates as well as hand-mapped estimations in survey reports.

3.3.3.2 Current Condition and Trends

Current conditions and trends for most special status plant species and significant plant communities are summarized in Tables 3.3.5 and 3.3.6, respectively.

Table 3.3.5 Special Status and Other Potentially Sensitive Plant Species in the Planning Area

Common Name	*Scientific Name*[1]	*Agency Status*	*CNHP Rank*	*Notes*	*Probability of Occurrence*
De Beque Phacelia	*Phacelia submutica (Phacelia scopulina var. submutica)*	Federal Threatened	G2/S2	Colorado endemic. Ephemeral annual. Restricted to sparsely vegetated, steep slopes on clays of Atwell Gulch and Shire members of Wasatch Formation. Soils often have large cracks due to shrink-swell potential of the clays: 4,700 to 6,200 feet.	Likely
Parachute Penstemon	*Penstemon debilis*	Federal Threatened	G1/S1	Colorado endemic. One of rarest plants in North America, known from five locations, two of which are in Planning Area. Restricted to sparsely vegetated south-facing talus in Mahogany Zone of Green River Formation: 7,800 to 9,000 feet.	Definite
De Beque Milkvetch	*Astragalus debequaeus*	BLM Sensitive	G2/S2	Colorado endemic. Restricted to fine-textured, seleniferous or saline soils, Wasatch Formation – Atwell Gulch Member: 5,100 to 6,400 feet.	Definite
Piceance Bladderpod	*Lesquerella parviflora*	BLM Sensitive	G2G3/S2S3	Colorado endemic. Restricted to shale outcrops of the Green River Formation on ledges and slopes of canyons in open areas: 6,200 to 8,600 feet.	Likely
Roan Cliffs Blazingstar	*Mentzelia rhizomata (Mentzelia argillosa)*	BLM Sensitive	G3/S2	Restricted to steep, shale talus or scree slopes derived from the Parachute Creek member of the Green River Formation: 5,570 to 9,100 feet.	Definite
Sun-Loving Meadowrue	*Thalictrum heliophilum*	BLM Sensitive	G3/S3	Colorado endemic. Restricted to sparsely vegetated, steep south-facing shale talus slopes derived from the Green River Formation.	Definite
Hanging Garden Sullivantia	*Sullivantia hapemanii* var. *purpusii*	USFS Sensitive, Former BLM Sensitive	G3T3/S3	Colorado endemic. Restricted to calcareous seeps, often derived from Green River Formation. Known only from five counties in western Colorado; 62% of all known populations occur in the Planning Area.	Definite
Dragon Milkvetch	*Astragalus lutosus*	Former BLM Sensitive	G4/S3S4	Restricted to shale barrens of the Green River Formation. Primarily in the Piceance Basin in Colorado, but some in Utah as well. BLM sensitive species designation dropped with discovery of several populations. Not considered as a sensitive plant species for this analysis.	Definite

Table 3.3.5 Special Status and Other Potentially Sensitive Plant Species in the Planning Area

Common Name	*Scientific Name*[1]	*Agency Status*	*CNHP Rank*	*Notes*	*Probability of Occurrence*
Wetherill Milkvetch	*Astragalus wetherillii*	Former BLM Sensitive	G3/S3	Occurs on sandy clay soils derived from shale or sandstone on slopes, canyon benches, and talus under cliffs. Often the only plant found on dry washes on rocky clay hillsides. Known in seven Colorado counties and in Utah. Dropped from BLM sensitive species list due to increased number of known occurrences. Not considered as a sensitive plant species for this analysis.	Definite

Source: BLM 2014d.

Notes:
[1] Synonymies in parentheses.
Nomenclature follows CNHP 1997a and 1998.

Key:
G = Global rarity
S = State rarity
G1 or S1 = 5 or fewer occurrences
G2 or S2 = 5 to 20 occurrences
G3 or S3 = 20 to 100 occurrences

Table 3.3.6 Significant Plant Communities in the Planning Area

Community	*Scientific Name* [1]	*CNHP Rank*	*Notes*	*Status in Planning Area*
Quaking Aspen/Rocky Mountain maple forest	*Populus tremuloides/Acer glabrum*	G1G2/S1S2	Few locations in Colorado.	Present
Boxelder riparian forest (Boxelder/ narrowleaf cottonwood/red-osier dogwood)	*Acer negundo (Negundo aceroides)/ Populus angustifolia/Cornus stolonifera (Cornus [Swida] sericea))*	G2/S2	Rare in Colorado and globally.	Present
Great Basin grassland (Beardless bluebunch wheatgrass community)	*Pseudoroegneria spicata (Agropyron spicatum) ssp. inermis*	G2/S2	Three locations in Colorado.	Present
Great Basin montane grassland (Beardless bluebunch wheatgrass/Sandberg bluegrass community)	*Pseudoroegneria spicata (Agropyron spicatum) ssp. inermis/ Poa secunda*	G4/S1	A single occurrence in the Planning Area on Gardner Peak.	Present
Montane riparian forest (blue spruce/red-osier dogwood)	*Picea pungens/Cornus stolonifera (Swida) sericea*	G1G2/S1S2	Rare in Colorado and globally.	Present
Old-growth Douglas-fir forest	*Pseudotsuga menziesii*	NA	Considered a remnant and exemplary occurrence of type in region.	Present
Sagebrush bottomland shrubland (Mountain big sagebrush/Great Basin wildrye)	*Artemisia tridentata ssp. vaseyana (Seriphidium vaseyanum)/ Leymus (Elymus) cinereus*	G4/S2	Limited in Colorado.	Present
Western slope grassland (Indian ricegrass shale barrens)	*Oryzopsis hymenoides (Achnatherum hymenoides)([Stipa] hymenoides)*	G2/S2	Rare in Colorado and known globally from only three counties in Colorado.	Present
Sullivantia hanging gardens	*Sullivantia hapemanii/Aquilegia barnebyi*	G3/S3	Known from five counties in western Colorado; 62 percent of all known community locations occur in the Planning Area.	Present

Source: BLM 2014d.

Notes:
[1] Synonymies in parentheses.
Nomenclature follows CNHP 1997a and 1998
G = Global rarity
S = State rarity
G1 or S1 = 5 or fewer occurrences
G2 or S2 = 5 to 20 occurrences
G3 or S3 = 20 to 100 occurrences

Key:
NA = Not applicable

Seven special status plant species are known or thought likely to occur in the Planning Area. These include two species listed under the ESA and four BLM sensitive species. Three species formerly considered by the BLM as sensitive also occur in the Planning Area. Two of these species, De Beque milkvetch (*Astragalus debequaeus*) and De Beque phacelia (*Phacelia submutica*), are Colorado endemics and are restricted to Wasatch Formation outcrops. These outcrops occur below the rim and extend from the vicinity of De Beque to Rifle (about 30 miles). Five of these species are endemic to Colorado or the region and are restricted to particular oil shale outcrops, where they have often been found to occur together in a community. These include Parachute penstemon (*Penstemon debilis*), Roan Cliffs blazingstar (*Mentzelia rhizomata*), sun-loving meadowrue (*Thalictrum heliophilum*), and Piceance bladderpod (*Lesquerella parviflora*), among others.

ESA Listed, Proposed, or Candidate Threatened or Endangered Species

De Beque Phacelia (*Phacelia submutica*)

This small, ephemeral plant is listed as a threatened species under the ESA, with a global distribution from approximately 10 miles northwest of the Little Bookcliffs to 2 miles northeast of De Beque (and several miles south of De Beque). It is restricted to steep slopes on clays of the Atwell Gulch and Shire Members of the Wasatch Formation. These soils often have large cracks because of high shrink-swell potential of the clay. This plant is a pioneer species, specifically adapted to an environment where most plants cannot grow (CNHP 1995). A BLM ecologist visited all three reported locations and has found no evidence of De Beque phacelia and no suitable habitat in the vicinity. While, there are no known occurrences of the species in the Planning Area, there is potential habitat within the Planning Area. However, it has been noted that the annual habit of the species allows it to respond dramatically to environmental conditions. In some years several thousand plants may be observed, and in other years the same site may produce no plants (CNHP 1995). This dynamic must be considered when assessing potential impacts to this species.

Parachute Penstemon (*Penstemon debilis*)

A Colorado endemic, this is one of the rarest plant species in North America. Only five populations of this species are known. Of these, two populations are entirely on private land. A third is split between private land and the BLM GJFO. The remaining two populations occur on public land in the CRVFO within the Planning Area. Parachute penstemon is listed as Federally threatened. The species is considered critically imperiled (G1/S1) by the CNHP based on its very few occurrences, narrow global distribution, and the current and potential threat to all of its known populations.

This species is restricted to soils classified as Parachute-Irigul-Rhone channery loams on steep slopes of decomposing shale. The geology of known locations all occur just above the Mahogany Zone of the Parachute Creek Member of the Green River Formation (CNHP 1997a). It is finely adapted to steep and constantly moving talus slopes. The soils in these areas comprise thin shale fragments and clay. The stems of Parachute penstemon plants elongate downslope from their initial rooting point, the leaves often become buried by shifting shale shards. When these stems encounter a surface sufficiently stable, they may develop a tuft of leaves, flower, and set seed.

One of the two populations in the Planning Area (on a steep open slope adjacent to the Anvil Points Rim Road) is quite small and has diminished steadily over the past decade. The location of this population was first recorded in 1991. Nearly 300 individuals were observed in this population in 1994. Seven plants were found in 1997. By 1998, only three individuals (McMullen 1998) and from 2002 to 2014, only one or two plants have been observed. The cause of this decline has not been determined. Livestock grazing is not thought to be a factor, as the area is steep and sparsely vegetated. The steepness of these slopes also limits OHV use and subsequent infestation by noxious weeds.

The other population of Parachute penstemon in the Planning Area occurs on a bench below the plateau rim and adjacent to portals of the Anvil Points mine. This population appears to be stable and comprises approximately 500 to 1,000 individuals. Scattered plants occur above the Anvil Points Mine Road and a few occur in the fill below. It may be that the road, itself, being a flat, packed gravel surface, is limiting recruitment and establishment of additional individuals in this area. Maintenance to this road would pose a threat to some of these plants, as well as a number of Roan Cliffs blazingstar in the same vicinity.

Research on the biology of Parachute penstemon (McMullen 1998) has found that it requires a pollinator for reproduction, but there is no indication that this limits its survival. Seeds of the species do not require native shale soils for germination, nor do seedlings require shale soils for growth and early establishment. Soil analyses suggest that soil chemistry is probably not a direct factor in the endemism of this species, either.

All known locations of this species share a number of characteristics that result from natural erosion processes and promote relatively continual disturbance. These include very steep slopes, unstable shale surface layers, and no surface soil. It has been noted that two of the largest populations, one being the Anvil Mines population, occur in the vicinity of human-caused disturbances that date to the decade previous to the populations' discovery (McMullen 1998). However, with no information about the condition of the populations prior to this disturbance, it is not clear how the species is responding to these disturbances except to note that they continue to persist.

BLM Sensitive Species

De Beque Milkvetch (*Astragalus debequaeus*)

This BLM sensitive species is found only on outcrops of Wasatch Formation between Little Bookcliffs and Rifle, Colorado. Ten occurrences are known on the Atwell Gulch Member of this formation, near the bottom of the Roan Cliffs in the central part of the Planning Area (Map 23). These populations are at the eastern edge of the species' range. Little is known about its habitat needs and life history requirements. Protection has been recommended to prevent Federal listing as a threatened species (CNHP 1997b).

The populations of De Beque milkvetch occur within, and immediately adjacent to, an area being developed for natural gas. In this area, surface-disturbing activities, such as construction of roads and well pads, may impact De Beque milkvetch populations by destroying individual plants as well as fragmenting habitat. Nearly 90 percent of the occupied habitat is already leased. Many of these leases (approximately 2,400 acres) are old, with standard stipulations that allow the relocation of a pad, road, or other source of surface disturbance up to 200 meters to protect resources at risk. The other leases (2,573 acres) were issued under the terms and conditions of the 1999 ROD and RMPA that provides a CSU stipulation. Other potential threats to this species in this area include OHV travel, activities associated with oil shale extraction and processing, incursion of noxious weeds, and trampling by livestock.

Piceance Bladderpod (*Lesquerella parviflora*)

This species is endemic to talus slopes of the Green River Formation. This species occurs in Rio Blanco, Mesa, and Garfield counties and has been found in areas contiguous to the Planning Area but has not been documented there. As it is very likely to occur, and is often found with other rare oil shale species, it is considered to be appropriate for consideration in further analysis.

Roan Cliffs Blazingstar (*Mentzelia rhizomata*)

This species represents a recent taxonomic reclassification (Reveal 2002) for the species formerly referred to as Roan Cliffs blazingstar (*Nuttallia argillosa*) (Weber and Wittman 2001). Under this new classification, the species is considered a Colorado endemic, widely distributed but edaphically restricted

to steep, shale talus or scree slopes derived from the Parachute Creek member of the Green River Formation. Its known range includes the general vicinity of the Roan Plateau, north of the towns of De Beque and Parachute, as well as the ridge and plateau north of the Book Cliffs and the city of Grand Junction (Reveal 2002). Roan Cliffs blazingstar often occurs with other species restricted to the same substrate. Like some other oil shale endemic species, this plant appears to be an early pioneer species, adapted to the steep slopes and constant shifting talus and scree slopes of the Green River Formation, e.g. the population along the Anvil Mine Road is quite large, extending from above the mine bench nearly 1,000 feet down the slope. There is some concern that if such areas eventually stabilize and are revegetated with other later seral species, the Roan Cliffs blazingstar may be locally exterminated (CNHP 1997a). Potential causes of reduced slope instability, aside from the geologic time scale, could include burial by fines associated with future mining, oil and gas construction, or misguided reclamation effort.

Populations of Roan Cliffs blazingstar occur in the Planning Area on talus slopes along the forks of Parachute Creek, along the south rim of the Roan Cliffs, and on steep drainage slopes below the cliffs where Green River shale has been deposited by washout from the cliffs above. The populations above the rim and near the falls on the East Fork Parachute Creek are small, but appear to be healthy and self-sustaining. The populations along the drainages at the base of the cliffs are also small and more exposed to anthropogenic disturbance.

Sun-Loving Meadowrue (*Thalictrum heliophilum*)

This Colorado endemic was listed by USFWS as a Category 2°C species in 1985. The species is restricted to sparsely vegetated, steep, south-facing shale talus slopes derived from the Parachute Creek Member of the Green River Formation in the Piceance Basin. It is frequently found with other oil shale restricted species such as dragon milkvetch, Parachute penstemon, and Roan Cliffs blazingstar (O'Kane 1987; Reveal 2002). Because of limited suitable substrate, this species tends to occur in three population clusters. While, there are no known occurrences of the species in the Planning Area, there is potential habitat within the Planning Area. This plant is considered a pioneer species because of its ability to colonize unstable, environmentally severe sites. In fact, it is quite likely that the sites it occupies may never host other vegetation types due to unstable substrate and very steep slopes. The ability of the species to withstand human-caused disturbance is not known (O'Kane 1987). Sun-loving meadowrue is known from only 36 locations in Garfield, Mesa, and Rio Blanco counties, seven of which occur within the Planning Area, one on BLM land.

Other Potential Special Status Plant Species

Hanging Garden Sullivantia (*Sullivantia hapemanii* var. *purpusii*)

Another Colorado endemic, this species is restricted to "hanging gardens" with a substrate of Green River Formation shale. These gardens occur where moisture seeps between layers of shale or in proximity to waterfalls. This species is most abundant on East Fork Parachute Creek and its tributaries, as well as in Northwater Creek Canyon. These populations appear stable and secure because their relative inaccessibility on steep cliffs protects them from surface disturbances, grazing, and noxious weed invasion. However, any physical disruption to the cliffs, or changes to the local hydrological processes that support the species' habitat, could have severe effects on these populations.

Although the hanging garden sullivantia currently has no BLM status, the USFS considers it a sensitive species. While it is known from several occurrences in five counties in western Colorado, 32 of the 52 known locations (62 percent) occur within the Planning Area. Therefore, negative impacts to any of these 32 occurrences would result in impacts to, or the loss of, a major portion of the global population. This species is, therefore, sensitive and included in the impact analysis. This species is also the dominant and defining taxon for the Sullivantia Hanging Gardens significant plant community.

Dragon Milkvetch (*Astragalus lutosus*)

The dragon milkvetch is restricted to Green River Formation oil shale and is frequently found with other oil shale endemic species. It is primarily found in the Piceance Basin of Colorado, including four locations in the Planning Area on shale outcrops at the top of the Roan Cliffs, as well as a few locations in Utah. It was formerly listed as a BLM sensitive species. However, the BLM designation was dropped as several more populations have been found. Because this species is now considered relatively common, it will not be considered in further analysis.

Wetherill Milkvetch (*Astragalus wetherillii*)

The Wetherill milkvetch occurs in sandy clay soils derived from shale or sandstone on slopes, canyon benches, and talus under cliffs. It is often the only plant found in dry washes on rocky clay hillsides. Populations are known in seven Colorado counties and in Utah. This species has been dropped from the BLM sensitive species list due to discovery of additional occurrences and is not considered in this analysis as a sensitive species.

Significant Plant Communities

Fifteen relatively rare plant communities tracked by the CNHP have been identified in the Planning Area (CNHP 1997a). Of these, eight are considered to have global rarity ranks of G1 or G2 and/or State rarity ranks of S1 or S2 and are managed by the BLM to maintain the current excellent condition. These communities are listed in Table 3.3.6 and described below. Significant plant communities are referred to by descriptive names below. Specific plant species that define the communities are provided in parentheses.

Quaking Aspen/Rocky Mountain Maple Forest (*Populus tremuloides/Acer glabrum*)

This community type is dominated by two relatively common mountain species that rarely co-occur to form communities. As such, they are only known from a few scattered locations in Colorado (CNHP 1997a). In the Planning Area, this community occurs in two 40-acre stands near the headwaters of First Anvil Creek and Second Anvil Creek. These areas appear to be healthy, climax stands with good regeneration of both aspen and Rocky Mountain maple. The understory in these areas is productive and diverse. The Anvil Points Rim Road cuts through one of these stands, and weeds invading along the roadsides could potentially degrade overall community health.

Boxelder Riparian Forest (*Acer negundo/Populus angustifolia/Cornus [Swida] sericea*)

Although all of these species are common in Colorado, this combination is restricted to few sites in western Colorado. One high-quality example is located in the Planning Area along the box canyon below the falls in East Parachute Creek. No noxious weeds have been documented along this reach of the stream. Noxious weeds in adjacent areas pose a concern for the continuing health of this community.

Great Basin Grassland (*Pseudoroegneria spicata(Agropyron spicatum* ssp. *inermis*)

Great Basin grassland is dominated by beardless bluebunch wheatgrass, and has only been recorded in three locations in Colorado in the Piceance Basin, specifically in Rio Blanco and Garfield counties (CNHP 1997a). The rarity of this community may be due to heavy grazing pressures throughout much of its historical natural range (Baker 1983). This plant community occurs on slopes or on broad ridgetops and plateaus that often gently slope to the south or southwest. In the Planning Area, this community occurs along the eastern rim of the cliffs from East Anvil Points to the vicinity of the JQS trail. Several spurs off of the Anvil Points Rim Road dissect portions of the area, causing fragmentation of the grassland community and increasing the potential for noxious weed invasion. Otherwise, this grassland

community is currently in good condition and is subject to only light grazing pressure at this time because of restricted water availability.

Great Basin Montane Grassland (*Pseudoroegneria spicata [Agropyron spicatum] ssp. inermis/Poa secunda*)

This grassland assemblage reaches its southern limit in Utah and Colorado. This plant community is more widely distributed in Idaho, Montana, Wyoming, and eastern Washington and Oregon. The community occurs on extremely dry windswept knolls and exposed slopes with grades of 2 to 10 percent. In the Planning Area, this community occurs only once, on Gardner Peak. The community is currently in good condition and is subject to only light grazing pressure at this time because of restricted water availability.

Montane Riparian Forest (*Picea pungens/Cornus [Swida] sericea*)

Considered globally rare, this combination of species is only found in western Wyoming, northern New Mexico, Arizona, and a few locations in western Colorado, including along East Fork Parachute Creek above the falls. Noxious weeds such as houndstongue and Canada thistle are threats to this community as they are increasingly common along riparian habitats in the Planning Area and can out-compete native vegetation. This results in changes to community composition and reduced bank stability.

Old-Growth Douglas-Fir (*Pseudotsuga menziesii*)

Douglas-fir is relatively common along north-facing drainages in Colorado. However, mature ("old-growth") stands are becoming increasingly rare. The Planning Area encompasses several small but excellent examples of old-growth Douglas-fir forest covering approximately 1,730 total acres on the cliffs north of the JQS Road. This community occurs as a number of stringers and large patches along north-facing slopes. It is considered an excellent example of its community type by the CNHP and comprises a healthy mosaic of dense and open areas. Some small areas exhibit signs of beetle infestation. There is no human development within or immediately adjacent to this community type.

Sagebrush Bottomland Shrubland (*Artemisia tridentata* ssp. *vaseyana [Seriphidium vaseyanum]/Leymus [Elymus] cinereus*)

This association is known from Idaho, Nevada, and northwestern Colorado. Its limited distribution may be explained by an unusual combination of habitat characteristics: moist, but not saturated, deep soils along flat to gently sloping areas, in a narrow elevation range of 7,000 to 8,800 feet. This plant community may also be rare due to livestock grazing, as wild rye is very palatable to cattle and is quickly utilized. This community is found in three locations in the Planning Area: two near Anvil Points and one along Bull Gulch. All are considered to be in fair to moderate condition. All are subject to only light grazing pressure at this time due to restricted water availability. However, several roads dissect these communities, causing fragmentation and increased risk of noxious weed infestation.

Western Slope Grassland (*Achnatherum hymenoides) ([Stipa] hymenoides*)

Also referred to as shale barrens (TRW 1981), this sparse grassland community (often less than 25 percent vegetation cover) is extremely limited in distribution. This community occurs only in three counties in western Colorado. It is restricted to south-facing slopes with soils derived from shales or mudstones. Within the Planning Area, this community is found on south-facing slopes of East Fork Parachute, Northwater, Trapper, and Ben Good creeks.

Sullivantia Hanging Gardens (*Sullivantia hapemanii-(Aquilegia barnebyi*)

Sullivantia hanging gardens are highly localized environments found in canyons with perennial water sources (seeps) that form pocketed wetlands and allow the draping of vegetation across wet cliff faces.

Known from five counties in western Colorado, 62 percent of all known populations occur in the Planning Area.

3.3.3.3 Current Management and Desired Future Conditions

The 1984 GSRA RMP contains no specific objective for managing special status plant species, because few such species and locations were known to exist within the Resource Area at that time.

For NOSR 1 (on top of the plateau), the 1999 ROD and RMPA deferred decisions on surface-use stipulations to the Planning Area land use planning process (including this RMPA/SEIS). Standards for special status plants and significant plant communities in the remaining GSFO portion of the Planning Areas below the rim are met through the application of an NSO for ESA listed threatened or endangered species and the habitat needed for their maintenance or recovery, and a CSU for BLM sensitive plants and significant plant communities.

Special status plant species within the Planning Area should be managed to meet or exceed the special status species Land Health Standard (#4) (BLM 2006, Appendix F). This includes the requirement "that there are stable and increasing populations of endemic and protected species and that suitable habitat is available for recovery of endemic and protected species."

BLM policy and guidance for the conservation of special status species is outlined in BLM Manual 6840, which directs the BLM to consider these species to be those …*which are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act; those listed by a State in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by each State Director as sensitive*. Actions authorized by the BLM are to be consistent with the conservation of such species and should not contribute to the need to list any special status species under the provisions of the ESA. The manual further directs: *The objectives of the BLM special status species policy are: A. To conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for these species, and B. To initiate proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA.*

The 1997 WRRA RMP contains specific objectives for threatened and/or endangered plant species and sensitive plants and remnant vegetation associations (BLM 1996a). Within the WRFO portion of the Planning Area, vegetation resources are managed to enhance and maintain sustainability for ecological conditions within plant communities. To help meet these objectives, the WRRA portion of the Planning Area may apply its existing NSO, TL, and CSU stipulations.

3.3.4 Special Status Fish and Wildlife

Information describing the Affected Environment for Terrestrial and Aquatic Wildlife is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. New information and data include updates to species listing status; known species occurrence data; and incorporation of updated BLM manuals and handbooks.

3.3.4.1 Introduction

The BLM is directed to ensure that no action requiring Federal approval contributes to the need to list a species as threatened or endangered under the ESA. This protection also applies to species that are proposed or candidates for listing and to species designated by each BLM State Director as sensitive

(2001b). It provides BLM sensitive species criteria, policy, and guidance for the conservation of special status plant and animal species and the ecosystems upon which they depend. The manual directive is as follows: to conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for these species; and to initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA.

3.3.4.2 Current Conditions and Trends

Current conditions and trends for most special status fish and wildlife species are summarized in the AMS (BLM 2002a). The 1988 amendment to the Fish and Wildlife Conservation Act mandates the U.S. Fish and Wildlife Service (USFWS) to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973" (USFWS 2008). The discussion below and information presented in Table 3.3.7 address USFWS listed or candidate threatened or endangered fish and wildlife species, ESA listed Birds of Conservation Concern 2008 (USFWS 2008) BLM sensitive species, USFS sensitive species, State-listed threatened or endangered species, and State-listed species of special concern (SSC) that are known to occur, or that could occur, in the Planning Area and vicinity.

Table 3.3.7 Special Status and Other Potentially Sensitive Animal Species within the Planning Area Vicinity [1]

Common Name [2]	*Scientific Name*	*Status [3]*	*Agency [4]*	*Primary Habitat or Location in Area*
Invertebrates				
Great Basin Silverspot/Nokomis fritillary	*Speyeria nokomis nokomis*	Sensitive	USFS	wet meadows, seeps
Fishes				
Bluehead Sucker	*Catostomus discobolus*	Sensitive	BLM, USFS	Colorado River, Parachute Creek
Flannelmouth Sucker	*Catostomus latipinnis*	Sensitive	BLM, USFS	Colorado River, Parachute Creek
Razorback Sucker	*Xyrauchen texanus*	Endangered Threatened	USFWS CPW	Colorado River
Humpback Chub	*Gila cypha*	Endangered	USFWS CPW	Colorado River, not in Planning Area
Bonytail Chub	*Gila elegans*	Endangered	USFWS CPW	Colorado River, not in Planning Area
Roundtail Chub	*Gila robusta*	Sensitive SSC	BLM, USFS CPW	Colorado River and Parachute Creek
Colorado Pikeminnow	*Ptychocheilus lucius*	Endangered Threatened	USFWS CPW	Colorado River
Colorado River Cutthroat Trout	*Oncorhynchus clarki spp. – Green Lineage*	Threatened Sensitive SSC	USFWS BLM, USFS CPW	East Fork Parachute Creek and its tributaries
Colorado River Cutthroat Trout	*Oncorhynchus clarkii pleuriticus* – Blue Lineage (native to White/Yampa river basins)	Sensitive	BLM, USFS CPW	East Middle Fork Parachute Creek, Northwater Creek, Trapper Creek

Table 3.3.7 Special Status and Other Potentially Sensitive Animal Species within the Planning Area Vicinity [1]

Common Name [2]	*Scientific Name*	*Status [3]*	*Agency [4]*	*Primary Habitat or Location in Area*
Amphibians				
Boreal Toad	*Bufo boreas*	Sensitive Endangered	BLM, USFS CPW	ponds, marshes
Northern Leopard Frog	*Rana pipiens*	Sensitive SSC	BLM, USFS CPW	ponds, streams
Reptiles				
Smooth Green Snake	*Liochlorophis vernalis*	Sensitive	USFS	riparian, shrublands
Midget Faded Rattlesnake	*Crotalus viridis concolor*	Sensitive SSC	BLM CPW	rocky, arid areas
Birds				
White-faced Ibis	*Plegadis chihi*	Sensitive	BLM	marshes, shores
Greater Sandhill Crane	*Grus canadensis tabida*	Sensitive	BLM	marshes, fields
American Peregrine Falcon	*Falco peregrinus anatum*	Sensitive SSC BCC	BLM, USFS CPW USFWS	cliffs, rivers
Prairie Falcon	*Falco mexicanus*	BCC	USFWS	cliffs, grassland
Northern Harrier	*Circus cyaneus*	Sensitive BCC	USFS, USFWS	grassland, pasture
Bald Eagle	*Haliaeetus leucocephalus*	SCC Sensitive BCC	CPW BLM USFWS	rivers, lakes
Ferruginous Hawk	*Buteo regalis*	Sensitive SSC BCC	BLM, USFS CPW USFWS	cliffs, open land
Swainson's Hawk	*Buteo swainsoni*	BCC	USFWS	woods, grassland
Golden Eagle	*Aquila chrysaetos*	BCC	USFWS	cliffs, grassland
Northern Goshawk	*Accipiter gentilis*	Sensitive	BLM, USFS	aspen, spruce/fir
Greater Sage-Grouse	*Centrocercus urophasianus*	Sensitive SSC BCC	BLM, USFS CPW USFWS	Sagebrush, mountain shrub, riparian, and wetlands (brood-rearing)
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	Sensitive	BLM, USFS	sagebrush, mountain brush/grassland
Flammulated Owl	*Otus flammeolus*	Sensitive BCC	USFS USFWS	montane forest
Burrowing Owl	*Athene cunnicularia*	Sensitive Threatened	BLM, USFS CPW	prairie dog towns
Mexican Spotted Owl	*Strix occidentalis*	Threatened	USFWS CPW	dense old-growth conifers, canyons
Boreal Owl	*Aegolius funereus*	Sensitive	BLM, USFS	conifers, aspen
Black Swift	*Cypseloides niger*	Sensitive BCC	USFS USFWS	waterfalls

Table 3.3.7 Special Status and Other Potentially Sensitive Animal Species within the Planning Area Vicinity [1]

Common Name [2]	*Scientific Name*	*Status [3]*	*Agency [4]*	*Primary Habitat or Location in Area*
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Threatened Sensitive SSC	USFWS USFS CPW	riparian forests, not present in Planning Area
Lewis's Woodpecker	*Melanerpes lewis*	Sensitive BCC	USFS USFWS	pinyon/juniper, riparian
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Sensitive BCC	USFS USFWS	aspen, spruce/fir
American Three-toed Woodpecker	*Picoides tridactylus*	Sensitive	USFS	spruce/fir, aspen
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered BCC	USFWS CPW USFWS	not in area
Olive-sided Flycatcher	*Contopus cooperi*	Sensitive BCC	USFS USFWS	spruce/fir
Purple Martin	*Progne subis*	Sensitive	USFS	riparian, aspen
Brown Creeper	*Certhia americana*	Sensitive	USFS	conifers
Loggerhead Shrike	*Lanius ludovicianus*	Sensitive BCC	USFS USFWS	open woodlands, low shrubs, grassland
Pinyon Jay	*Gymnorhinus cyanocephalus*	BCC	USFWS	pinyon/juniper
Gray Vireo	*Vireo vicinior*	BCC	USFWS	pinyon/juniper
Virginia's Warbler	*Vermivora virginiae*	BCC	USFWS	mountain brush
Black-throated Gray Warbler	*Dendroica nigrescens*	BCC	USFWS	pinyon/juniper
Brewer's Sparrow	*Spizella breweri*	Sensitive	USFS	sagebrush
Sage Sparrow	*Amphispiza belli*	Sensitive BCC	USFS USFWS	sagebrush
Juniper Titmouse	*Baeolophus griseus*	BCC	USFWS	pinyon/juniper
Cassin's Finch	*Haemornus cassinii*	BCC	USFWS	grassland
Mammals				
Spotted Bat	*Euderma maculatum*	Sensitive	BLM, USFS	caves, cliffs, trees
Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Sensitive SSC	BLM, USFS CPW	caves, cliffs, trees
Fringed Myotis	*Myotis thysanodes*	Sensitive	BLM, USFS	caves, cliffs, trees
Yuma Myotis	*Myotis yumanensis*	Sensitive	USFS	caves, cliffs, trees
Big Free-tailed Bat	*Nyctinomops macrotis*	Sensitive	BLM	caves, cliffs, trees
American Marten	*Martes americana*	Sensitive	USFS	conifers
River Otter	*Lutra canadensis*	Sensitive Threatened	USFS CPW	rivers, streams

Table 3.3.7 Special Status and Other Potentially Sensitive Animal Species within the Planning Area Vicinity [1]

Common Name [2]	*Scientific Name*	*Status [3]*	*Agency [4]*	*Primary Habitat or Location in Area*
Wolverine	*Gulo gulo*	Endangered	CPW	conifer forest
Lynx	*Lynx lynx*	Threatened Endangered	USFWS CPW	conifer forest

Notes:
[1] Based on BLM (2015c), USFS (2015), CPW (2015), and USFWS (2015).
[2] Bold type indicates ESA listed, or candidate threatened or endangered species.
[3] BCC = Birds of Conservation Concern (USFWS 2002), SSC = Special Concern (Colorado Division of Wildlife 2006).
[4] All Federal threatened or endangered species are also State-listed by CPW.

Table 3.3.7 also includes species not documented to occur onsite but considered potentially present is based on the types of habitats present and proximity to the known geographic range. Species with only a remote potential for transitory occurrence are not included. Table 3.3.7 also lists species designated as sensitive by the USFS in the White River National Forest and potentially present in the Planning Area. While the BLM is not mandated to manage for species listed as sensitive by USFS, this Draft RMPA/SEIS includes selected USFS-listed species in recognition that much of the area of the Planning Area atop the plateau consists of habitats more similar to National Forest lands than typical BLM lands in the region.

Some of the species listed in Table 3.3.7, and some additional species not listed, are considered by CNHP to be of global or statewide concern based on declining numbers and imperiled habitat (including habitats used during seasons when the species is not present in the region, low numbers in some areas, such as on the edges of the range, or occurrence as geographically restricted subspecies) (CNHP 2015).

ESA listed, Proposed, or Candidate Threatened or Endangered Species

Colorado River Fishes (Endangered)

Four members of the minnow and sucker families that occur in the Colorado River in western Colorado and eastern Utah are ESA listed as endangered. Designated critical habitat for both the Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) occurs within the Colorado River and its 100-year floodplain along the southern boundary of the Planning Area, downstream from the town of Rifle. Designated critical habitat for the humpback chub (*Gila cypha*) and bonytail chub (*G. elegans*) occurs in the Black Rocks area near the Colorado-Utah border more than 80 miles downstream from the Planning Area.

All of these species require a diversity of habitats within a large river. Low-velocity side channels, backwaters, oxbows, sloughs, and flooded bottomlands are important habitats for spawning and survival of young fish, particularly for the pikeminnow and razorback sucker. Populations of Colorado pikeminnow are low but relatively stable in the upper Colorado River Basin, while numbers of razorback suckers are smaller. Recovery efforts are ongoing and include releases of hatchery-reared fish. Likewise, bluehead, flannelmouth, and roundtail can and do inhabit smaller tributaries such as Parachute Creek seasonally during spawning activities and as nursery areas for young fish.

The decline of these fishes is mostly attributed to changes in the Colorado River resulting from the impoundment of large portions of the main stem and its tributaries. In addition, irrigation use and dams have dewatered, cooled, and otherwise altered much of the river system. The “controlling” of the river has resulted in loss of habitat and interference with natural function, such as flooding. Many of these changes

in the river system have resulted in more favorable conditions for non-native fishes introduced into tributary streams or lakes to provide a recreational fishery. These non-native fishes can compete for food, space, cover, and physical habitat, and may prey on young life stages of the native fishes.

Other threats to survival or recovery of the Colorado River fishes include the introduction of chemical pollutants and the further depletion of streamflow associated with consumptive use of water for a variety of purposes.

Mexican Spotted Owl (Threatened)

This ESA listed subspecies of Mexican spotted owl (*Strix occidentalis lucida*) is typically found in moist, mature forests in canyons of the southwestern United States. Its documented geographic range does not include the Planning Area or surrounding portions of Colorado (Kingery 1998). However, the BLM has mapped suitable habitat in the first mile extending downstream from the East Fork Parachute Creek waterfall (Map 22). Potentially suitable habitat also occurs on private land in lower portions of the East Fork and East Middle Fork drainages and the Magpie Gulch area. Specific surveys for sensitive species (e.g., CNHP 1997a, 1998) have not resulted in observations of this secretive owl.

Western Yellow-billed Cuckoo (Threatened)

The yellow-billed cuckoo (*Coccyzus americanus*) was recently listed as threatened in the Western United States as a distinct population segment. Western yellow-billed cuckoos breed in large blocks of riparian habitats, particularly woodlands with cottonwoods (*Populus* spp.) and willows (*Salix* sp.). Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat in areas where the species has been studied in California (USFWS 2013). Western yellow-billed cuckoos winter in South America. Western yellow-billed cuckoos are primarily foliage gleaners, though they can catch flying prey or drop to the ground to catch grasshoppers or tree frogs.

This species historically occurred in portions of western Colorado, although it was likely never common and is now extremely rare and an uncommon summer resident. The available data indicate that cuckoos do not nest within this broad highlands region, and reveal few records of cuckoos at all in the mountainous region of the State (USFWS 2013).

Since 2000, detections of the western yellow-billed cuckoo distinct population segment (DPS) have been limited in western Colorado, and consistent cuckoo observations have been recorded at only two locations in western Colorado:

- Since 2001, cuckoos have been detected annually in the San Luis Valley of south-central Colorado in Conejos County where breeding is suspected, but not confirmed (USFWS 2011a); and
- Since 2003, cuckoos have been detected annually at the North Fork of the Gunnison River valley of west-central Colorado in Delta County; breeding was confirmed in 2008 near Hotchkiss (USFWS 2011a).

Reports of single western yellow-billed cuckoos have primarily originated from the Grand Junction area and Mesa County in 2001, 2002, 2005, and 2008, with a report of more than one cuckoo at Orchard Mesa Wildlife Area in 2006. Additional reports include an individual south of Montrose in Montrose County near the Uncompahgre River in 2009, an individual along the Gunnison River near Gunnison in 2007, and detections by the Rocky Mountain Bird Observatory along the Yampa River near Craig in 2007 and 2008, and in far western Colorado near Nucla in 2005 and 2008 (USFWS 2011a).

No individuals have been recorded or confirmed to nest on BLM lands within the Planning Area. Habitat analysis reveals that potentially suitable habitat is present at two locations along the Colorado River and one location along the Eagle River in the CRVFO (BLM 2014d). None of these areas are included within the Planning Area; therefore, western yellow-billed cuckoos are not considered further in this SEIS.

Southwestern Willow Flycatcher (Endangered)

The southwestern willow flycatcher (*Empidonax traillii extimus*) is an endangered subspecies known to occur in riparian willow and tamarisk habitats of extreme western and southwestern Colorado; however, the Planning Area is outside its known geographic range (Kingery 1998). Therefore, this species is not considered further in this SEIS.

Canada Lynx (Threatened)

The Canada lynx (*Lynx lynx canadensis*) has recently been reintroduced in Colorado as part of a recovery program. Although the species has not been documented within the Planning Area, it should be noted that no systematic surveys have been conducted. Some portions of the approximately 18,150 acres of mixed aspen/conifer habitat atop the plateau appears suitable for the lynx in terms of plant species composition and community structure. Additionally, the Planning Area is known to support a population of a favorite prey species, the snowshoe hare, as well as other suitable prey: dusky grouse (*Dendragapus obscurus*), mountain cottontail (*Sylvilagus nuttallii*), and the young of deer and elk. Reintroduced lynx have begun to reproduce in Colorado and are gradually moving into areas outside those where releases occurred. Overall, however, the potential for dispersal of lynx into the Planning Area is reduced by the limited amount and patchiness of the suitable habitat and by its isolation from more suitable and more extensive habitats in the White River National Forest.

Colorado River Cutthroat Trout – Green Lineage (Threatened)

Recent genetic (Metcalf et al. 2012) and meristics (Bestgen et al. 2013) research suggests that two lineages of CRCT exist in western Colorado where it was originally thought that only one existed. The two genetically distinct lineages are currently called the Blue Lineage – native to the Green, White, and Yampa river basins, and the Green Lineage – native to the Colorado, Dolores, and Gunnison river basins. The USFWS has directed the Federal land management agencies to consider the Green Lineage fish as threatened until such time as they make a formal interpretation and determination on the new genetic and meristic research on cutthroat trout in the State of Colorado. As part of ongoing cutthroat trout management in the planning area, Colorado Parks and Wildlife worked with the BLM to remove nonnative brook trout from the East Fork Parachute Creek watershed. Four miles of stream in the headwaters was treated in 2014 and brook trout were removed. Colorado Parks & Wildlife stocked CRCT – Green Lineage fish in the summer of 2015 in the treated reach. Colorado Parks & Wildlife plans to complete the removal of brook trout in the remainder of the watershed in 2016 and manage the entire watershed atop the plateau as a genetically pure CRCT – Green Lineage population.

BLM and USFS Sensitive Species, Colorado Threatened or Endangered Species and Species of Special Concern, and USFWS Birds of Conservation Concern

Native Non-Game Fishes

The flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*C. discobolus*), and roundtail chub (*Gila robusta*) are BLM and USFS sensitive species found in the mainstem of the Colorado River along the southern boundary of the Planning Area and potentially present in lower portions of Parachute Creek. These species are experiencing declines throughout their range, and numbers of individuals in the region near the Planning Area are not known. Declines in these species are mainly attributed to changes in the Colorado River resulting from changes in the flow regime and water quality associated with impoundments and diversions for agriculture. The “controlling” of the river has resulted in loss of habitat

and natural function, such as flooding. In addition to loss of habitat function, many of these changes in the river system have resulted in more favorable conditions for non-native fishes, which are now common and compete with native fishes for resources such as food, space, cover, and physical habitat. They are also known to prey on the young of native fishes.

The same general riparian protection stipulations described previously for the ESA listed endangered fishes also provide some habitat protection for these species.

Colorado River Cutthroat Trout – Blue Lineage

Based on recent genetic (Metcalf et al. 2012) and meristics (Bestgen et al. 2013) research, two lineages of CRCT exist in western Colorado where it was originally thought that only one existed. The two genetically distinct lineages are currently called Blue Lineage – native to the Green, White, and Yampa river drainages, and Green Lineage native to the Colorado, Dolores, and Gunnison river basins.

The streams atop the plateau within the planning area were historically fishless. CRCT – Blue Lineage were documented as being stocked into resident streams as early as 1960 (Behnke 1976) and possibly earlier. Streams within the Planning Area that currently contain populations of Blue Linage cutthroat trout include Northwater Creek, Trapper Creek, East Middle Fork Parachute Creek, and mainstem Parachute Creek (Map 17). The populations in Northwater Creek, Tapper Creek, and East Middle Fork Parachute Creek (above the barrier falls) are considered core conservation populations based on genetic purity of greater than 99 percent (Hirsch et al. 2013). The population in the East Fork Parachute Creek drainage (East Fork Parachute Creek, First Anvil Creek, JQS Gulch, Second Anvil Creek) was functionally extirpated and replaced by nonnative brook trout that were introduced into the watershed back in the mid 1970's. Removal of brook trout has been initiated by Colorado Parks and Wildlife, and CRCT – Green Lineage have been stocked into this watershed and are addressed above under the section titled: ESA listed, Proposed, or Candidate Threatened or Endangered Species.

Segments of two Planning Area streams (4 miles each of Northwater Creek and Trapper Creek) are designated as core conservation populations (Hirsch et al. 2013). This designation, based on a genetic purity greater than 99 percent, was also confirmed by the DNA assessment of Evans and Shiozawa (2004). Their study combined results for samples of 24 fish from Northwater Creek in 2001 with data samples from the same creek in 1998 (Shiozawa and Evans 2000).

Disappearance of CRCT in other areas has resulted from overfishing, interbreeding with other subspecies of cutthroat trout due to stocking by State fish and wildlife agencies, and competition from more aggressive, non-native trout species, including the rainbow, brown, and brook trout. Fortunately for the CRCT, the Planning Area historically received so little use by anglers (due to its isolation and remoteness) that no pressure was placed on CPW to stock gamefish. Until recently, this would have meant the introduction of non-native trout species, including non-native subspecies of the CRCT. Just as important, the extreme physical barriers between larger streams stocked by CPW and the isolated streams atop the Roan Plateau prevented upstream dispersal of non-native species and subspecies.

In light of the new genetic and meristic research on cutthroat trout in Colorado, as well as the need to update information for the SEIS, the BLM reevaluated the populations and their habitats on the Roan Plateau. After a review of the new information, the BLM interdisciplinary team concluded that the Blue Lineage CRCT found on the Roan Plateau remain a BLM sensitive species. Because of their genetic purity, resident populations are still irreplaceable Conservation Population of CRCT, which is rare within and outside the range of the Blue Lineage fish.

Until such time as the USFWS makes a formal determination on the status of cutthroat trout in Colorado, the BLM will continue to consider all of the populations within the planning area as important for

management emphasis. The BLM believes that, even after the USFWS review is completed, the populations of cutthroat trout on top of the Roan Plateau will continue to be regarded as a regionally important and protected genetic resource, despite being located outside their natural range.

Current or potential risk factors to the lineages include damage to stream channel morphology and riparian vegetation by livestock, impacts from OHV travel, sediment deposition, chemical pollution, loss of hydrology (water depletions), and unsanctioned releases of non-native trout. Features that characterize high-quality trout habitat include: healthy riparian vegetation (with trees and shrubs present for temperature moderation, seclusion, and enhanced bank stability), a high pool-riffle ratio (for spawning, temperature moderation, and seclusion); a suitable and diverse substrate, low erosion potential, and good physicochemical conditions (water quality, including temperature, pH, hardness, alkalinity, salinity, total dissolved solids, total suspended solids, and specific metals and ions). Additionally, water diversions and depletions area factors impacting these fish with regard to habitat maintenance and creation. Other risk factors would include turbidity, loss of shading, and increase in water temperature.

The conservation agreement and strategy for CRCT (Hirsch et al. 2013), of which BLM was a contributor and signatory, discusses risks to this species and describes measures that could be undertaken to conserve (maintain and restore) both the species and its habitat. These include protecting existing populations and occupied habitats, ecosystem components that are crucial to these populations and habitats, and restoring degraded ecosystems both to reduce ongoing risks associated with the damaged ecosystem components and to increase potential habitat for future expansion.

Amphibians

The boreal or western toad *(Bufo boreas boreas)* was petitioned for listing as either the Eastern population or the Southern Rocky Mountain population DPS. In April 2012, the USFWS released a 90-day finding for initiating a review of the status of the Eastern population to determine if listing it as a DPS is warranted.

The Southern Rocky Mountain population is listed by the BLM as a sensitive species and by CPW as a State-listed endangered species. Historically, the boreal toad was widespread in Colorado in beaver ponds, oxbows, and isolated ponds at elevations between approximately 8,500 and 11,500 feet. In recent decades, however, the species has undergone a significant decline in terms of both numbers and sizes of populations. Although potentially suitable habitat occurs along drainages at higher elevations in the Planning Area, no populations have been documented there, nor is it known whether the species was ever present. A baseline study report prepared for DOE (TRW 1982) does not include the boreal toad among the amphibians and reptiles observed during surveys of NOSRs 1 and 3 in 1975, 1976, or 1980. The disjunct (isolated) nature of the upper montane/lower subalpine habitats of the Planning Area may have prevented colonization of potentially suitable habitats from occupied habitats elsewhere in the region.

One other anuran (tailless amphibians) that occur in the general region and has special status as BLM sensitive species is the northern leopard frog (*Rana pipiens*). Few suitable sites are present in the Planning Area for either species. The northern leopard frog ranges across much of the northern United States and southern Canada and has also been found in the Planning Area. This is an aquatic species, meaning that it requires permanent water such as that found along the margins of reservoirs, perennial ponds and pools, perennial springs, streams, and persistent marshes. As with many species of amphibians, populations have been declining throughout the range for unknown reasons, although a fungal infection is considered a major contributor. Habitat loss, pollution, and predation by introduced non-native bullfrogs are also threats to specific populations.

Reptiles

The midget faded rattlesnake (*Crotalus viridis concolor*) is a subspecies of the western or prairie rattlesnake, the most common viper in the region. The midget faded subspecies is both smaller and more pallid than the main species. It ranges across Utah and portions of Wyoming into west-central Colorado and is known to occur along rock outcrops below the Roan Cliffs. The subspecies is of concern in Colorado because of the small number of records and restricted range. Population trends within Colorado are unknown. Standards for these species are met through a CSU stipulation for BLM sensitive species.

One other special status serpent in the region is the smooth green snake (*Liochlorophis vernalis*). The smooth green snake occurs in western Colorado and could occur in the Planning Area, where it would most likely be found in moist or lush habitats such as riparian shrublands and moist meadows. The green snake, small and secretive, appears to be doing well in Colorado (Hammerson 1999).

Raptors

The northern goshawk (*Accipiter gentilis*) is rare to uncommon throughout its range; suitable habitat consists of unfragmented aspen or conifer forests in the upper montane and subalpine zones. This is a forest species that nests in tall trees and hunts for small birds and diurnal small mammals (e.g., squirrels) by darting through the forest and flushing its prey. It may winter at lower elevations, including pinyon/juniper woodland, adjacent to its breeding range. The species is not documented to occur atop the plateau, possibly because the conifer forest is too limited in extent or too linear in configuration (i.e., with too much edge for this large species).

The ferruginous hawk (*Buteo regalis*) is the largest breeding buteo in the region. Although this species is not documented to nest in the Planning Area, suitable nest sites occur along rock ledges and cliffs and in pinyon/juniper woodlands. This is a hawk of open country; potential hunting habitats are present in all of the lower elevation areas below the cliffs, and in expanses of xeric shrubland on ridges atop the plateau. Although apparently not breeding onsite, the ferruginous hawk occurs during winter and migration seasons.

Another special status raptor, the American peregrine falcon (*Falco peregrinus anatum*), was previously listed under ESA as endangered, downgraded to threatened, and then delisted following successful recovery, mostly because of bans on certain types of pesticides. The peregrine is known to nest on the Roan Cliffs (at least two pairs have been reported) and to hunt for its preferred prey, waterfowl, along the Colorado River. Peregrines may also take other birds, including rock doves, band-tailed pigeons, and grouse. The proximity of high cliffs to a large river that remains at least partially ice-free during the winter is ideal for this species. The location provides secure nest sites, and the river supports waterfowl, a good source of prey year-round. The Planning Area contributes substantially to the regional recovery of the species (Map 22).

The bald eagle (*Haliaeetus leucocephalus*) was previously federally-listed as threatened, and was de-listed in August 2007. The species is doing well throughout its range, mostly because of bans on certain pesticides but also related to aggressive enforcement of intentional shooting by ranchers. This species is known to occur within the Planning Area. Bald eagles winter along portions of the Colorado River and Parachute Creek, and possibly along East Fork Parachute Creek (BLM 2002a), generally from mid-November to mid-April. Wintering numbers vary annually, depending on climatic conditions. Large cottonwoods along the Colorado River and Parachute Creek are used as roosting and perching sites, and the waterways provide the main food sources: fish and waterfowl. Upland habitats adjacent to the waterways are used as scavenging areas, primarily for winter-killed mule deer and elk and other carrion. Bald eagles prey on small mammals to some extent, but are especially prone to stealing the prey captured by smaller raptors such as buteo hawks. Although the bald eagle historically nested along the Colorado

River in the vicinity of the Planning Area, it is not currently known to nest in the area. As populations rebound following de-listing, future use of the area for nesting is not unlikely.

The small boreal owl (*Aegolius funereus*) is listed as sensitive by USFS in the nearby White River National Forest. This species is a year-round resident in subalpine conifer forests, such as those that occur to a limited extent atop the plateau, and was found on the Planning Area during CNHP inventories completed in 1996. Areas of mature old-growth Douglas-fir along the cliffs provide potential habitat, but are below the usual elevational range for this species.

Another small owl, the burrowing owl (*Athene cunnicularia*) is listed by the BLM and USFS as sensitive, and by CPW as threatened in Colorado. This species is primarily associated with prairie dog colonies and uses abandoned prairie dog burrows for nesting. Because of the lack or limited occurrence of prairie dogs in the Planning Area, this species is assumed to not occur onsite, although it could use open habitats at lower elevations for feeding during migration. The species could occur onsite in the future if prairie dogs become established in greater numbers.

Waterbirds

One special status wading bird (white-faced ibis, *Plegadis chihi*) is known to occur as a migrant in the Planning Area. This species is most likely to occur along major water bodies, including the Colorado River and Fravert Reservoir. A TL stipulation provides some protection of nesting and brood-rearing in the Fravert Reservoir Watchable Wildlife Area within the Planning Area.

Gallinaceous Birds

Greater Sage-Grouse

The greater sage-grouse (*Centrocercus urophasianus*), currently a SSC and listed as BLM Sensitive, occurs in areas of extensive sagebrush habitat in the region. Although the species is not currently known to occur in the Planning Area, historic records exist for the Hubbard Mesa area. Occupied habitat is present north of the Planning Area in Rio Blanco County and west of the Planning Area in parts of Garfield County and extends northward through much of northern and northwestern Colorado.

Within the past few years, CPW has mapped the top of the Roan Plateau as general habitat for the greater sage-grouse, based on monitoring of one radio-tagged male bird and incidental observations of other individuals. Previous surveys mapped the planning area as non-habitat for greater sage-grouse (CGSGSC 2008). Telemetry data collected by CPW and BLM indicated the use of mixed sagebrush-grassland-snowberry habitats along the rim of the Roan cliffs by one individual throughout the summer (May to late August) in 2006. Incidental observations have occurred in the northern part of the Planning Area, where sagebrush-covered ridges are broader, less dissected, and contiguous with more extensive sagebrush habitat north of the Planning Area in the White River Field Office (WRFO). There is sagebrush below the rim, but these areas are not considered habitat.

The apparently small population of greater sage-grouse on the top of the plateau falls within the Parachute-Piceance-Roan population. In this area, virtually all seasonal use takes place on relatively narrow mid-elevation ridges north of the Planning Area, with movement to higher elevations, such as the Roan Plateau, through the brood rearing and general summer use periods. Winter use appears to occur at all elevations within this zone, extending north into the WRFO from the top of the plateau, depending on accumulated snow depth and snow texture. Winter use by sage-grouse is possible in the northern part of the Planning Area, based on vegetation structure. However, the higher elevation of the upper plateau than areas to the north may limit or preclude winter use due to deep and persistent snow cover.

The Planning Area is outside of the defined "breeding habitat" for greater sage-grouse, as outlined in the Colorado Greater Sage-Grouse Conservation Plan (CGSGSC 2008), although late summer/fall habitat is available and would potentially include late brood rearing and the transition to wintering habitats. At this time, no leks (i.e., communal courtship and breeding sites) are known in the Planning Area. Nesting selection is not uniform across the range, with 80 percent of females selecting nest sites within 4 miles of a lek site (Hausleitner 2003; CGSGSC 2008). Nesting in the Planning Area has not been documented and is considered unlikely, but potentially occurs at the western end of the upper plateau, which is within 4 miles of known lek sites on private lands farther west.

Brood rearing activity is the most likely use of the Planning Area, based on the type of habitat present (a mosaic of sagebrush on ridges and slopes and mesic [i.e., moist] meadows along drainage floors). Use of these areas, to the extent it may occur, would be expected to begin approximately three weeks following hatching, by which time the young are capable of flight and, therefore, there is dispersal across greater distances.

The Northwest Colorado Greater Sage-Grouse Proposed Land Use Plan Amendment (LUPA) and Final EIS (NWCOGSG FEIS) (BLM 2015d) was released in June 2015. In conjunction with this planning effort, which includes the top of the Roan Plateau, the BLM and CPW have preliminarily mapped greater sage-grouse habitat. This mapping effort designates three categories of habitat:

- **Priority Habitat Management Area (PHMA)** – Areas identified as having the highest conservation value to maintaining sustainable populations, include breeding, late brood rearing, and winter concentration areas;

- **General Habitat Management Area (GHMA)** – Areas of seasonal or year-round habitat within occupied range outside PHMA; and

- **Linkage/Connectivity Habitat** – Areas identified as broader regions of connectivity important to facilitate movement and maintain ecological processes.

Collectively, PHMA, GHMA, and linkage/connectivity habitat are referred to as all designated habitat (ADH). In the above-mentioned planning effort, the entire Planning Area above the rim was mapped as ADH, due to the general nature of the mapping effort (Map 22). With the exception of 30 acres in the far northwest corner of the Planning Area, all of the ADH is GHMA. This very small polygon in the northwest corner of the Planning Area is considered PHMA, all of which is on private land. GHMA is also designated as an avoidance area for major (high-voltage transmission line and pipelines greater than 24 inches) and minor BLM ROWs.

It is understood that, at the implementation level, areas that are not considered suitable habitat for greater sage-grouse, such as aspen and conifer stands, will not be treated as such.

New oil and gas lease stipulations consistent with the regional LUPA will be analyzed in this Draft RMPA/SEIS. New or additional COAs specified in the regional LUPA would also be analyzed. Because the habitat mapping prepared for the LUPA is a small-scale mapping effort covering the northwestern quarter of Colorado, site-specific habitat suitability would be analyzed on a project-specific basis. This more detailed information would be used to assess habitat quality for greater sage-grouse and potential seasons and types of use as a basis for ensuring appropriate project location, design, and timing. The presence of greater sage-grouse was not recognized during the initial analysis of the Planning Area and was, therefore, not analyzed in the original EIS. BLM's NWCOGSG FEIS (BLM 2015d) does not propose management decisions for the Planning Area; thus, this SEIS includes a new greater sage-grouse analysis and incorporates applicable content by reference from the NWCOGSG FEIS.

The Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) is a species of mixed habitats, including mountain shrub, grassland, and riparian components. Cultivated fields of alfalfa and small grains are important at certain times of the year, as are aspen and small stands of conifers with open grassy parks. An unconfirmed sighting of this species was made during CNHP surveys in 1996, but its status in the Planning Area is unknown.

Small Birds

No small birds in the Planning Area are currently listed as BLM sensitive species. However, several species, including neotropical migrants, are known to occur or likely to occur within the Planning Area. The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." *Birds of Conservation Concern 2008* (USFWS 2008) is an effort to carry out this mandate. The overall goal of this effort is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities. The current BCC list (USFWS 2008) for Region 16 (Southern Rockies/Colorado Plateau) includes 11 species potentially present in or near the Planning Area:

- Bald eagle (*Haliaeetus leucocephalus*);
- Golden eagle (*Aquila chrysaetos*);
- Flammulated owl (*Otus flammeolus*);
- Western yellow-billed cuckoo (*Coccyzus americanus*);
- Lewis's woodpecker (*Melanerpes lewis*);
- Willow flycatcher (*Empidonax traillii*);
- Gray vireo (*Vireo vicinior*);
- Pinyon jay (*Gymnorhinus cyanocephalus*);
- Juniper titmouse (*Baeolophus griseu*s);
- Brewer's sparrow (*Spizella brewer*i); and
- Cassin's finch (*Haemornus cassinii*).

Species included on the BCC list for the Southern Rockies/Colorado Plateau (the region that includes the Planning Area) are shown in Table 3.3.7. Juniper titmouse and Cassin's finch were not included on the 2002 BCC list used in the Roan FEIS, but are included in the 2008 BCC.

All of the native birds in the Planning Area, with the exception of upland gamebirds, are protected by the Migratory Bird Treaty Act of 1918, as amended (MBTA). The MBTA protects individual birds from being harassed, injured, or killed, and also protects active nests and eggs. The protection of nests, eggs, and young extends to human activities that lead to nest failure, such as by interfering with brooding of the eggs or feeding of the young or by causing one or both adults to abandon the nest.

Bats

Four bat species listed by the BLM are potentially present in the area (BLM 2002a) and either known or likely to occur in the Planning Area: Townsend's big-eared bat (*Corynorhinus townsendii*), spotted bat (*Euderma maculatum*), fringed myotis (*Myotis thysanodes*), and Yuma myotis (*M. yumanensis*). Three additional species (the long-legged myotis (*M. volans*), long-eared myotis (*M. evotis*), and big free-tailed bat (*Nyctinomops macrotis*)—are listed in the 1999 FSEIS as potentially occurring in the region. The last species is a BLM sensitive species listed as occurring in the Grand Junction resource area, while the other two are not on the current list of BLM sensitive species (BLM 2002a). All of these bats roost in abandoned mine shafts, caves, rock niches, overhangs, trees, or buildings. The cliffs, mine adits, and the cave area provide a plethora of roosting sites within the Planning Area.

Carnivores

Two species listed as sensitive by USFS within the Planning Area vicinity include the river otter (*Lutra canadensis*), listed as threatened by CPW, and the North American wolverine (*Gulo gulo luscus*), listed as endangered in Colorado by CPW. The river otter was previously listed as sensitive by the BLM. This highly mobile, wide-ranging species has been introduced at various locations around the State and could eventually disperse along the Colorado River and major tributaries adjacent to the Planning Area (e.g., Parachute Creek). However, river otters are not currently known to occur in or near the Planning Area.

North American wolverines have a circumpolar distribution in the Northern Hemisphere. They inhabit remote wilderness areas and their habitat is often inaccessible to humans (Pasitschniak-Arts and Lariviere 1995). This species is found in tundra, taiga, boreal, and alpine biomes, all relatively unproductive, often freezing habitats, where growing seasons are short and snow persists into the summer. Wolverines were extirpated in historical times from the Sierra Nevada and the southern Rocky Mountains (USFWS 2012a).

Within the contiguous United States (which constitutes a DPS), wolverine habitat is restricted to high-elevation areas in the West. Currently, wolverines appear to be distributed in two regions in the lower 48 states: the northern Cascades in Washington, and the northern Rocky Mountains in Idaho, Montana, and Wyoming. Historic populations that have not yet reestablished were found in the southern Rocky Mountains and the Sierra Nevada (76 Federal Register 207). Because wolverines do not appear to specialize in specific vegetation or geological habitat, but rather select areas that are cold, a deep, persistent, and reliable spring snow cover (April 15 to May 14) is the best overall predictor of wolverine occurrence in the contiguous United States (USFWS 2012a).

Home ranges of wolverines are very large, but vary greatly depending on availability of food, gender, age, and differences in habitat. These home range sizes are large for mammals of the size of wolverines and may indicate that wolverines occupy a relatively unproductive niche (USFWS 2012a). The wolverine occupies a unique niche by accessing scarce food resources available in these environments, despite the presence of deep snow-cover, and caching these resources in cold, rocky areas that inhibit competition from insects, bacteria, and other scavengers (CPW 2012). Wolverines have an excellent sense of smell that enables them to find food beneath deep snow and are opportunistic feeders; they consume a variety of foods depending on availability. Wolverines primarily scavenge carrion, but also prey on small animals and birds, and eat fruits, berries, and insects (USFWS 2012a).

In Colorado, nearly all historical and recent reports of wolverines are from higher elevations, in isolated alpine areas. Until recently, the last confirmed wolverine sighting in Colorado was in 1919. In spring 2009, researchers with the Greater Yellowstone Wolverine Program tracked a wolverine from Grand Teton National Park south into north-central Colorado. This was the first wolverine confirmed in the State in 90 years and is the only known wolverine in Colorado (CPW 2012). On July 8, 2010, the CPW Commission granted CPW's request to begin discussions on restoring wolverines with CPW's partners and stakeholders. No wolverines are known or suspected to exist within the Planning Area at this time.

In 2010, the USFWS determined that wolverines found in the contiguous United States warranted protection under the ESA, but a rulemaking proposing the species for protection was precluded by higher priority species. On February 4, 2013, the USFWS proposed to list the wolverine as a threatened species (78 Federal Register 7864) in the states that it is known to occur, and subsequently published a Federal Register notice that extended the deadline for the final listing decision. The Act allows for such an extension when there is substantial scientific disagreement regarding the sufficiency or accuracy of the available data relevant to the decision at issue. During the peer review process on the proposed rule to list the wolverine as threatened, a variety of opinions from the scientific community were received concerning the information that was used to develop the proposed rules. In response, the deadline was extended for the final listing decision by 6 months (August 4, 2014) to further evaluate areas of scientific

disagreement and uncertainty as they relate to the wolverine listing decision. On August 13, 2014, the USFWS withdrew the proposal to list the wolverine in the contiguous United States as a threatened species under the ESA.

The populations in Colorado, Wyoming, and New Mexico were proposed as "Nonessential Experimental Populations." Section 10(j) of the ESA provides for the designation of specific reintroduced populations of listed species as "experimental populations;" however, the USFWS withdrew the proposed listing on February 4, 2013.

Current Management and Desired Future Conditions

Section 7 of ESA requires the BLM to ensure that any action authorized, funded, or implemented is not likely to jeopardize the continued existence of any species that is ESA listed, or proposed for listing as threatened or endangered and does not reduce the likelihood of recovery of any affected species. Species proposed for Federal listing are managed with the same level of protection as for listed species. BLM policy also ensures that no action contributes to the need to list a species as threatened or endangered (BLM 2001b). This policy applies to candidate species under ESA and to BLM sensitive species.

The 1984 GSRA RMP contained no specific objective for managing special status species, but identified monitoring, maintaining, or improving habitat for threatened or endangered species as a priority for implementation. For NOSR 1 (on top of the plateau), the 1999 ROD and RMPA deferred decisions on surface-use stipulations to the RMPA/EIS (BLM 2006). For areas below the rim, the following stipulations have previously been developed to help protect special status species and their habitats:

- **Major River Corridors** – Avoid a 0.5-mile buffer on either side of the Colorado River (NSO 3);
- **Riparian and Wetland Zones** – Avoid ground disturbing activities inside the zone of riparian vegetation (NSO 2). Additionally, activities within 500 feet may require special design, and the BLM may require relocation of a proposed activity by more than 200 meters to protect the resource (CSU 2);
- **Raptors (general)** – Avoid a 0.125-mile buffer around raptor nests year-round (NSO 7) and a 0.25-mile buffer from February 1 through April 15 (TL 6);
- **Bald Eagles** – Avoid a 0.25-mile buffer around a nest or roost site year-round (NSO 8), a 0.5-mile buffer around nest sites from December 15 to June 15 (TL 10), and a 0.5-mile buffer around roost sites from November 15 to April 15 (TL 11).;
- **Peregrine Falcons** – Avoid a 0.25-mile buffer around the cliff-nesting complex year-round (NSO 9) and a 0.5-mile buffer from March 15 to July 31 (TL 12);
- **Threatened or Endangered Species** – Avoid occupied habitat and any habitat required for the maintenance or recovery of the specific species (NSO 12);
- **Waterfowl and Shorebird Nesting** – Avoid a 0.25-mile buffer around the nesting and brood-rearing habitat of Fravert Reservoir (TL 13); and
- **BLM Sensitive Species** – Special design of proposed ground disturbing activities or relocation by more than 200 meters may be required to protect the resource (CSU 3).

For the small portion of the Planning Area in Rio Blanco, the 1997 WRRA RMP listed the following management goals for special status species: "(1) contribute to the recovery of special status animals (i.e.,

listed, proposed, or candidate threatened or endangered or BLM sensitive) in an effort to ultimately remove these species from special status consideration; (2) maintain or restore special status animal populations, and the suitable extent and/or utility of important habitats on public lands; (3) ensure that federally authorized actions do not adversely disrupt or compromise important biological activities or contribute to increased mortality or depressed production or recruitment into a breeding population; and (4) maintain or improve, to PFC, bank, channel, and floodplain processes associated with designated critical habitats for listed and candidate fishes of the Upper Colorado River Basin."

Regarding BCCs, the Memorandum of Understanding (MOU) between USFWS, the BLM, and USFS states, "BLM will identify management actions that potentially affect migratory birds [and] develop, in coordination with USFWS and other agencies, conservation measures that are consistent with the agencies' missions to avoid or minimize take of migratory birds populations and/or that will provide habitat to benefit migratory bird populations." For birds protected by the MBTA, including neotropical migrants, the BLM has developed management measures as described in CO IM 2011-007.

The stipulations, COAs, and other management mechanisms that are delineated in the NWCOGSG FEIS (BLM 2015d) will be analyzed in this SEIS for potential incorporation into management actions. When considering a specific project or management activity, the BLM will evaluate the species and habitats to be affected, the type and intensity of the disturbance, and the timing and duration of the disturbance to determine an overall population effect.

3.3.5 Wild Horses and Burros

No managed populations of wild horses (*Equus caballus*) or wild burros (*Equus asinus*) occur in the Planning Area. Therefore, these non-native ungulates are not discussed in this RMPA/SEIS.

3.4 HUMAN ENVIRONMENT

3.4.1 Visual Resources

Information describing the Affected Environment for visual resources is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. Updates to the visual resource inventory results for the Planning Area are included.

3.4.1.1 Landscape Character and Scenic Quality

The overall landscape of the Planning Area is highly diverse and contains many outstanding features that are visible from many key viewing areas. The Roan Cliffs serve as a prominent backdrop in the scenery for the communities of Parachute, Battlement Mesa, Rifle, Silt, and New Castle and to travelers on I-70 and SH 13. Public sensitivity to landscape modifications is high.

The topographic relief is considerable, with the skyline rising 3,000 to 4,000 feet above the Colorado River valley floor. The dramatic contrast of the vertical shale cliffs giving way to the heavily vegetated slopes accentuates its rugged and scenic qualities, which are highly unusual.

Deep canyons carved into a rolling upland offer outstanding views, both within and outside the Planning Area. NOSRs 1 and 3 were identified as one of six high-quality scenic areas in the 1984 GSRA RMP. Scenic quality is defined as the degree of harmony, contrast, and variety that influences the overall impression of a landscape. East Fork Parachute Creek Canyon was determined to contain high scenic quality and is a significant visual resource, not only locally but regionally.

Lands Atop the Plateau

Areas at higher elevations atop the plateau consist of a diverse vegetation cover typical of the region. Spruce/fir and Douglas-fir dot the north facing slopes, while aspen woodlands dot the higher elevations along with mountain sagebrush. Mountain grasslands and shale barrens dominate the south-facing slopes. The plateau consists of long ridgelines that are dissected by headwater valleys of several drainages that turn into spectacular canyons dividing the plateau. East Fork Parachute Creek creates a deep and scenic canyon where a 200-foot-high waterfall near the western boundary plunges over white shale cliffs into a box canyon of National Park-quality scenery.

Overall, the landscape maintains a natural setting. The presence of management activities is less intrusive than below the cliffs. Land use modifications from management activities have been moderate. To date, most modifications are the result of livestock developments, which include roads, four cabins, ponds, stock tanks, and/or fence lines. The topography and vegetation screen a limited amount of management activities along the top of the main ridges and on north-facing slopes. However, man-made intrusions extending off ridgelines on sparsely vegetated slopes draw attention and can dominate the landscape.

Lands Below the Rim

Visual qualities have been maintained to date, due to the topography and ruggedness of the cliffs and slopes. However, private lands within the immediate foreground from I-70 and SH 13 have been visually impacted by commercial activities, oil and gas activities, roads, and urbanization.

Public lands within the foreground have limited visual impacts related to oil and gas activities, utility corridors, and recreational uses. Two roads currently dominate the landscape. The Anvil Points Oil Shale Mine access road dominates the southern viewshed as it winds across the steep, barren shale slopes. In addition the new JQS Road and evidence of the old JQS route are still visible on the southeastern cliffs.

3.4.1.2 Viewing Distance Zones and Visual Sensitivity

Viewing distance zones and visual exposure were evaluated to determine sensitivity from the selected key viewsheds. Viewing distance zones, expressed in terms of miles from the viewer, are:

- Close Range: Less than 0.25 mile;
- Near Foreground: 0.25 to 1 mile;
- Foreground: 1 to 3 miles;
- Midground: 3 to 5 miles; and
- Background: Greater than 5 miles.

In general, landscape features become more visible at decreasing distance from the observer due to the increase in scale and greater ability to discern the details of form, color, texture, and line. Objects viewed at a distance of less than 0.25 mile generally have the highest degree of visual sensitivity, and views in distances up to 5 miles are of decreasing importance. Views greater than 5 miles are typically of lowest importance in visual resource management. However, these generalizations about the importance of distance do not necessarily hold in the case of landscape features or modifications that are large, located in a topographically prominent area, or have a high degree of contrast with their surroundings.

Landscape features visible from many locations are also considered more important than those seen from only a few places. Elevated, significant topographic forms can dominate the landscape and attract

attention, even at considerable distances. Features are also more visually sensitive if they are large or significantly contrast with surrounding features. Presence or absence of intervening obstructions, such as vegetation, also affects visual exposure. The Roan Cliffs within the Planning Area exemplify all of these: the cliffs are large, stand high above the valley floor, are generally unobstructed, and contrast starkly in terms of color and texture from the vegetated foothills below.

While distance, location, and physical characteristics of a landscape modification are one aspect of visual sensitivity, another is related to the degree of public concern for the visual resources and scenic quality of a given site or region. Factors determining sensitivity levels include (1) types of users, (2) amount of use, (3) amount of public interest, (4) adjacent land uses, and (5) management objectives for special resources, such as the streams eligible for designation under the WSRA and lands with wilderness characteristics.

A viewshed analysis was conducted for key transportation corridors for this SEIS. The viewshed analysis was limited to lands within the Planning Area and was used to analyze possible impacts to visual values by alternative in Chapter 4.

3.4.1.3 Key Viewsheds

Based on major transportation routes, three key viewsheds receive the greatest amount of public viewing. These viewsheds include I-70, SH-13, and Rim Road, as discussed below.

Interstate 70 Viewshed

The I-70 viewshed includes all visible portions of the Planning Area along 16.5 miles of highway between Rifle and Parachute (Map 26). Actual annual traffic count data in 2002 on this segment of I-70 was more than 5.5 million cars (CDOT 2002). This viewshed area provides open, fully exposed views of the Roan Cliffs and Anvil Points and most of the south-facing landscape within the unit.

This viewshed is considered to be the most important, as this landscape is viewed by the largest number of people, including the adjacent communities of Battlement Mesa, Holms Mesa, and Morrison Mesa. While the prominent Roan Cliffs vary from 2 to 4 miles away in the landscape, its stark and unique character dominates this part of the Colorado River Valley.

The foreground slopes subtly downward away from the cliffs. Therefore, the vegetation and few overhead utility lines do not interfere with many views of the Planning Area. The composition of this viewshed is significantly varied in form and texture. The foreground includes multiple roads and existing landscape modifications, mostly occurring on private lands. Although these man-made impacts are highly visible, their relative low topographic position and small size compared to the plateau and cliffs diminishes their negative visual impact. Additionally, most impacts to date exist on generally flat, smooth terrain, minimizing topographic disturbance. Existing gas facilities and supporting infrastructure such as roads and pipelines are mostly discernible by the removal of vegetation, creating a substantial contrast in color, line, and texture.

State Highway 13 Viewshed

The SH 13 viewshed includes all visible portions of the Planning Area from 21.5 highway miles extending north from Rifle to Rio Blanco County (Map 27). This eastern-most edge of the Roan Cliffs becomes progressively less prominent toward the north and essentially ends at the northeastern edge of the Planning Area. Most of the intervening views are of private land.

The near foreground view composes more than half of the view of the landscape. Additionally, the natural landscape characteristics are repetitive and create few contrasts within the near foreground, foreground, and background. The most dominant natural forms are the cliffs in the background due to stark contrast in

color, texture, and form. The most dominant man-made feature is a continuous power line between the highway and cliffs. The JQS Road is also visible. Although smaller in visual composition, the road creates significant color and line contrasts in the landscape.

Rim Road Viewshed

The Rim Road viewshed consists of 18 miles of sinuous road that enters the northern boundary of the Planning Area along Cow Creek and heads eastward to the edge of the plateau (Map 28). The road follows the rim of the cliffs southward and then westward to Anvil Points and beyond. This is the main transportation route atop the plateau and provides outstanding views of the Flat Tops Wilderness Area on the east and Battlement Mesa and Mount Sopris to the south.

The top of the plateau as viewed from the Rim Road is characterized by diverse plant cover typical of the region. Spruce/fir and Douglas-fir stands cover north-facing slopes, aspen woodlands and mountain sagebrush dot the higher elevations, and mountain grasslands and shale barrens dominate south-facing slopes. Most of the near foreground and foreground views appear natural, with limited landscape modifications.

Other Viewsheds Considered but Not Analyzed

The three viewsheds selected for visual resource management (VRM) analysis were chosen because they represent the most highly traveled corridors along and within the Planning Area. Two other viewsheds along CR 215 (Parachute Creek Road) and JQS Road were also considered for analysis. CR 215 provides some views of the cliffs northeast of Parachute. Views near the southern end of CR 215 overlap broadly with those from I-70. Areas farther north along CR 215 provide different views, but the Roan Cliffs are either obscured by intervening low hills on private land or 4 miles distant. The JQS Road viewshed overlaps broadly with both the I-70 and SH 13 viewsheds. This viewshed also provides different views as it climbs westward through the area between SH 13 and the cliffs. This viewshed was not selected for analysis because of the much lower volume of travel than either I-70 or SH 13.

3.4.1.4 Current VRM Classes and Visual Resource Management

Current VRM objectives were established for some areas of the Planning Area in the 1984 GSRA RMP and 1997 WRRA RMP. VRM objectives are generally aimed at protecting the most scenic public lands, especially those most often viewed by the public. Objectives for the different VRM inventory and management classes are described in Appendix D and summarized as follows:

- **Class I** – Preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention;
- **Class II** – Retain the existing character of the landscape. The level of change to the characteristic landscape should be low;
- **Class III** – Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate; and
- **Class IV** – Provide for management activities that require major modifications of the existing character of the landscape.

The assignment of visual resource classifications serves two purposes within the planning process: (1) it provides the basis for considering visual values in an RMP process; and (2) it reflects resource allocation decisions made in the planning process. Current VRM classes for the Planning Area, based upon the latest VRM inventory and data standards, are shown on Map 24.

Visual Resource Inventory

The BLM completed a Visual Resource Inventory (VRI) of the planning area in 2013 as per Instructional Memorandum No. 2012-0055 (Visual Resource Data Standard). VRM Classes establish a measurable standard for the amount of change allowed to visual resources in a specific area. VRI Classes establish the general value of the landscape in terms of its scenic resources. VRM Classes range from I to IV with Class I allowing the least amount of change and IV allowing the most amount of change to the characteristic landscape. VRI Classes also range from I to IV with I being the highest value scenic resource and IV being the lowest value scenic resource. The acreage by VRI Classes for all lands in the Planning Area is shown below. The majority of the Planning Area is within VRI Class II (19 percent) and VRI Class IV (8 percent). VRI Class II areas possess outstanding scenic quality and high visual sensitivity. Such areas in the planning area include the Roan Cliffs and the East Fork Falls. VRI Class IV areas are generally areas undergoing oil and gas development, and/or industrial development, and have less visual variety. VRI Class IV areas are generally found along the ridges on top of the Roan Plateau, Hubbard Mesa, and Webster Mesa. The acreage by VRI 1 Classes for all lands in the Planning Area is shown below. The majority of the planning area is within VRI Class IV (47 percent) and VRI Class II (28 percent). VRI Class II areas possess outstanding scenic quality and high visual sensitivity. Such areas in the Planning Area include the Roan Cliffs and the East Fork Falls.

Table 3.4.1 lists the number of acres and percentage of the Planning Area in each VRI Class, along with the sensitivity and scenic quality ratings and distance zone.

Table 3.4.1 Visual Resource Inventory Classes, Sensitivity, Scenic Quality Rating Units and Distance Zones for the Roan Plateau Planning Area

	Acres	***% of Planning Area***
VRI Class		
I	0	0%
II	20,895	28.3%
III	18,082	24.5%
IV	34,827	47.2%
Sensitivity		
High	41,117	55.7%
Moderate	32,494	44.0%
Low	193	0.3%
Scenic Quality Rating		
A	349	0.5%
B	27,612	37.4%
C	45,843	62.1%
Distance Zones		
Foreground/Middleground	43,154	58.5%
Background	30,650	41.5%
Seldom Seen	0	0

Visual Resource Management

VRM objectives do not apply to non-BLM lands, but visual concerns may be addressed on split-estate where Federal minerals occur. VRM classes shown for non-public lands are an indication of the visual values for private lands. Private land values are protected by landowner discretion.

VRM Class II was assigned to a relatively small portion, approximately 1,620 acres, of the Planning Area along East Fork Parachute Creek Canyon and Bull Gulch. This area has maintained a high degree of visual integrity and scenic quality under the current set of management actions and will remain this way due to being a significant local and regional visual resource.

VRM Class II was assigned to the uppermost portion of the Roan Cliffs, East Fork Parachute Creek Canyon, and lands north of Trapper Creek. Modifications to the landscape in VRM Class II are currently occurring and are expected to occur into the future, due to ongoing oil and gas activities on both public and adjacent private lands. A stipulation is in place for lands available for lease for Class II lands. However, this mitigating stipulation does not account for the cumulative effects of management actions. To date, most of the VRM Class II areas have maintained visual integrity and scenic qualities.

Minimal surface disturbance has occurred on the landscape above the rim in the VRM Class III area. These areas have maintained their visual integrity and scenic qualities. No protective visual stipulations are in place for lands above the rim, as decisions relating to surface uses were deferred to this land use planning process.

Large portions of the lands above the rim were designated as Class III in the GSRA RMP and are inconsistent with the WRRA lands managed as Class II. These lands currently have very similar values and scenic qualities. The different classification for similar landscapes reflects that the two resource areas (GSRA and WRRA) were classified on two separate occasions several years apart. The remaining lower lands are Class IV. To date, these public lands have had very little visible landscape modifications, except within Hubbard Mesa and the utility corridor along SH 13.

BLM Manual H-8410-1, *Visual Resource Inventory* (BLM 1986), states that VRM Class V areas (i.e., areas for which visual enhancement is the management objective) are no longer treated as a management category. This Draft RMPA/SEIS addresses the three Class V areas identified in the previous RMP for the Planning Area and amends them for conformance with current BLM guidance.

3.4.2 Cultural Resources

Information describing the Affected Environment for Cultural Resources is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed.

3.4.2.1 Introduction

Archaeological and ethnographic sources indicate extensive prehistoric and historic use of the lands in the Planning Area. The following section summarizes the known prehistoric and historic resources in the Planning Area. A detailed discussion and analysis of previous cultural resource investigations and the prehistoric and historic background of the Planning Area are found in Hoefer et al. (2002).

3.4.2.2 Prehistoric and Historic Context

The prehistoric occupation of western Colorado began approximately 11,500 years ago (Table 3.4.1) and ended in 1881 with the removal of the Ute people to reservations. The prehistoric temporal sequence is divided into the Paleoindian, Archaic, Formative, and Protohistoric eras, as summarized in Table 3.4.2.

Table 3.4.2 Northern Colorado River Basin Prehistory Chronology

Era	*Tradition/Period/Phase*	*Dates*
Paleoindian	Clovis Tradition	11,500 - 6400 B.C.
	Goshen Tradition	11,500 - 10,500 B.C.
	Folsom Tradition	10,800 – 9500 B.C.
	Foothill-Mountain Tradition	9500 – 6400 B.C.
Archaic	Pioneer Period	6400 – 4500 B.C.
	Settlement Period	4500 – 2500 B.C.
	Transitional Period	2500 – 1000 B.C.
	Terminal Period	1000 – 400 B.C.
Formative	Anasazi Tradition	900 – 1100 A.D.
	Fremont Tradition	200 – 1500 A.D.
	Gateway Tradition	400 B.C. – 1300 A.D.
	Aspen Tradition	400 B.C. – 1300 A.D.
Protohistoric	Canalla Phase	1100 – 1650 A.D.
	Antero Phase	1650 – 1881 A.D.

Source: Reed and Metcalf 1999.

The Paleoindian era in western Colorado began around 11,500 B.C. and extends to 6400 B.C. The Paleoindians represent the first inhabitants of the North American continent beginning in the late Pleistocene. The first 2,000 years of this era encompass the Clovis, Goshen, and Folsom traditions. The dominant attributes of early Paleoindian assemblages are the use of lanceolate projectile points and the hunting of megafauna, including mammoth and extinct forms of bison, by highly mobile residential groups.

The Archaic era (6400 – 400 B.C.) follows the Paleoindian era. During the Archaic era, projectile point styles changed to include a wide variety of stemmed and notched forms for use with an atlatl. The use of ground stone became more common, and hunting shifted from the large Pleistocene megafauna to a wide variety of animals. Other Archaic era attributes included use of pit and basin structures for habitation, subsistence practices that included a greater use of lower caloric return foods, and greater material culture variability.

The Formative era (400 B.C. – A.D. 1500) follows the Archaic era and is the time when a horticultural subsistence pattern became established in parts of western Colorado. This era also includes non-horticultural groups who lived in the mountains and higher elevations unsuitable for horticulture. The Aspen Tradition (Reed and Metcalf 1999:140-145), which applies to the Planning Area, is proposed for the non-horticultural foraging archaeological occupations dating between 400 B.C. – A.D. 1300. Characteristics of this tradition include replacement of the atlatl by the bow and arrow, use of ceramics, intensification in subsistence (particularly seed procurement), major use of pit features with associated ground stone, and a general increase in the number of sites.

The Protohistoric era begins around A.D. 1100 – 1300 when Numic groups, such as the Ute, enter western Colorado. The Protohistoric era is divided into two periods: the pre-contact Canalla phase and the post-contact Antero phase (Reed and Metcalf 1999). Attributes of Canalla phase occupations include the use of Uncompahgre brown ware ceramics, Desert side-notched and Cottonwood projectile points,

wickiups and other brush structures, and a pedestrian hunting and gathering subsistence pattern. The Antero phase began with Ute and Euroamerican contact and is characterized by the use of the horse and Euroamerican artifacts, along with Uncompahgre brown ware and Desert side-notched and Cottonwood projectile points. The precise date the Utes entered western Colorado is unknown, but is generally acknowledged that it could have been as early as A.D. 1000. The Protohistoric era ends with the removal of the Ute peoples to reservations in 1881.

Western Colorado was one of the last areas of the western United States to be settled by Euroamericans, and the Planning Area is no exception. The difficult access into the area and the presence of the Ute peoples inhibited development for some 30 to 40 years after the Front Range of the Rockies was settled. The first Euroamericans in the area consisted of Spanish explorers, followed by fur trappers and government-sponsored scientific expeditions.

The initial settlement of the area was by miners from the mountains to the east, who decided to take up farming or ranching in western Colorado. These settlers claimed most of the good lands along the rivers and streams. By the time the railroad arrived in Rifle in 1889, the majority of this land was occupied. Prior to the arrival of the railroad, the population of the area was sparse, and towns had yet to develop. The railroad did open up the region and lead to the establishment of towns and new industries.

Rifle was initially settled in 1882 by Abraham Maxfield and developed into a trade center for local farms and ranches. Rifle was incorporated in 1905. What would become the town of Parachute was settled by Mike Callahan in 1882, followed in the same year by J.B. Hurlburt. In 1904, the name was changed to Grand Valley and incorporation occurred in 1908. The town was renamed Parachute in 1980.

The main economic pursuits in the early days were sheep and cattle ranching. In the early 1880s, sheep ranchers like J.B. Hurlburt grazed their herds on the Roan Plateau. In 1883, the JQS Cattle Company, formed by H.W. Hallett, was running 4,000 head of cattle and the Grand River Ranch and Cattle Company operated another large cattle ranch in the area. In 1885, the JQS stock trail was built by H.W. Hallett and William Chadwick to run cattle on the plateau.

Settlement of the upper Grand Valley was primarily by ranchers, but irrigated farming was also important. A number of small irrigation systems were built in the late 1800s. The most ambitious attempt at irrigation was undertaken by Arthur and Raymond Havemeyer. Through the Havemeyer Sugar Company, they invested in the Wilcox Canal Company, hoping to provide water for sugar beet crops. The Havemeyers financed the construction of a canal that was intended to irrigate 8,000 acres in the Webster Mesa and Sharrard Park areas. The sugar beet fields envisioned by the Havemeyers never materialized. On June 12, 1912, a flood destroyed the canal system. Attempts were made to repair the canal and pumps, but the irrigation system never watered any fields.

Extraction of fossil fuels is another economic pursuit with a long history in the area. Oil shale is plentiful, and attempts to capitalize on this resource began soon after the area was settled. In the 1890s, T.C. Bailey formed the Parachute Mining District for the sole purpose of building a shale retort and selling mining stocks. NOSR 1 was created in 1916, and the first oil shale facility was built by Harry Flynn in 1918 on Dry Fork, a tributary of Roan Creek near De Beque. By 1920, while over 10,000 claims had been filed, only 500 barrels of oil had been produced. Cheaper sources of fossil fuels in other parts of the nation prevented the development of the Roan Plateau oil shale reserves.

In an effort to experiment with oil shale recovery, the Bureau of Mines, in conjunction with the University of Colorado and Colorado School of Mines, received an appropriation of $90,000 from the Congress to study development of the oil shale reserves for the Navy. A facility was constructed near Rulison in 1925. The experiment was terminated in 1929 when it was determined that recovery of oil

from oil shale was not commercially viable. With the onset of World War II, interest in oil shale was revived, and an experimental plant was built at Anvil Points in 1944. The Anvil Points plant was used periodically into the 1970s. In the early 1980s, Exxon began planning for a massive oil shale development project, including establishment of a new community on Battlement Mesa. The towns of Rifle and Parachute attracted many people seeking employment in the oil shale mines and processing plants. In 1982, Exxon pulled out of the project due to the poor economics of oil shale processing, sending the local economy from a period of boom to relative bust.

3.4.2.3 Results of Previous Investigations

Over 200 cultural resource inventories have been conducted on a total of 73,728 acres of the Planning Area (Hoefer et al. 2002). Most of these inventories were on top of the plateau. Table 3.4.3 lists the survey acreage.

Table 3.4.3 Survey Acreage and Cultural Resource Density by Location

Subarea	*Total Acreage (% total)*	*Survey Acreage (% subarea)*	*All Resources Density (n = 429)*	*Prehistoric Resources Density (n = 327)*	*Historic Resources Density (n = 102)*
Lowlands	65,536 (51.6)	28,318 (43.2)	1 per 118 acres (5.42 per sq. mi.)	1 per 156 acres (4.10/sq. mi.)	1 per 480 acres (1.33/sq. mi.)
Uplands	61,471 (48.4)	45,410 (73.9)	1 per 242 acres (2.64 per sq. mi.)	1 per 313 acres (2.04/sq. mi.)	1 per 1,056 acres (0.61/sq. mi.)
Total	127,007 (100.0)	73,728	1 per 172 acres (3.72 per sq. mi.)	1 per 225 acres (2.84 per sq. mi.)	1 per 723 acres (0.87 per sq. mi.)

The data used to prepare the Class I overview of the prehistoric and historic cultural resources of the Planning Area were gathered from the CRVFO and the Colorado Historical Society Office of Archaeology and Historic Preservation. The Class I overview included data on 429 resources, comprising 327 prehistoric sites and isolated finds and 102 historic sites and isolated finds. These included 241 sites and isolated finds in the lowlands section of the Study Area and 188 in the uplands section. The lowlands and uplands are separated by the rim of the plateau, at approximately 8,000 feet in elevation. Table 3.4.4 details resource type by location.

Table 3.4.4 Cultural Resource Type by Location

Project Location	*Lowlands*	*Uplands*	*Total*
Prehistoric			
Isolate	91	49	140
Lithic Scatter	24	29	53
Open Camp	58	67	125
Other	9	0	9
Prehistoric Subtotal	**182**	**145**	**327**
Historic			
Isolate	1	1	2
Habitation	21	9	30
Ranch	6	9	15

Table 3.4.4 Cultural Resource Type by Location

Project Location	*Lowlands*	*Uplands*	*Total*
Mining	6	0	6
Transportation	4	0	4
Water Control	10	0	10
Aspen Art	0	21	21
Artifact Scatter	4	0	4
Other	7	3	10
Historic Subtotal	**59**	**43**	**102**
Total	**241**	**188**	**429**

The 429 prehistoric and historic resources have been evaluated for eligibility for nomination to the National Register of Historic Places (NRHP) using the criteria listed in 36 CFR 60.4. The sites have been evaluated as eligible for nomination to the NRHP, not eligible for nomination to the NRHP, or as potentially eligible for nomination to the NRHP. Sites listed as potentially eligible require further investigations before a NRHP evaluation can be made. Both eligible and potentially eligible sites are historic properties that must be managed under the mandates of the NHPA and other applicable statutes. Table 3.4.5 lists the NRHP eligibility of known sites.

Table 3.4.5 National Register Evaluations by Cultural Resource Type and Location

Resource Type	*Eligible*	*Potentially Eligible*	*Not Eligible*	*Total*
Prehistoric				
Isolate	0	0	140	140
Lithic Scatter	3	7	43	53
Open Camp	24	26	75	125
Other	2	2	6	10
Historic				
Isolate	0	0	2	2
Habitation	2	2	27	31
Ranch	2	0	12	14
Mining	1	0	5	6
Transportation	2	1	1	4
Water Control	3	0	7	10
Aspen Art	0	0	21	21
Artifact Scatter	0	0	4	4
Other	0	1	8	9
Total	**39**	**39**	**351**	**429**

3.4.2.4 Traditional Cultural Properties

No traditional cultural properties have been identified for the Planning Area. The following groups were formally contacted during the consultation process for the Class I Overview: the Ute Tribe of the Uintah and Ouray Agency, the Southern Ute Tribe, and the Ute Mountain Ute Tribe. These tribes confirmed that the Ute people occupied the Study Area, at least in historic times. During the Study Area site visit, the Ute Tribe of the Uintah and Ouray Agency tribal representatives indicated that the Yampatika band occupied the area around the Roan Plateau. Mr. Jim Jefferson, Southern Ute, indicated that the Uncompahgre Utes occupied the Roan Plateau. No traditional cultural properties, resource gathering areas, or areas of spiritual significance have been identified (Hoefer et al. 2002).

3.4.2.5 Sensitivity Zones

The Class I overview resulted in the delineation of sensitivity zones (Hoefer et al. 2002). These zones rate the area on the probability of locating additional cultural resources in either surface or subsurface contexts. The high-sensitivity zones exhibit a cultural resource density of one per 118 acres. The high-sensitivity zone encompasses 19,576 acres (15.4 percent) of the Planning Area. The moderate-sensitivity zone has a cultural resource density of one per 234 acres and encompasses 26,218 acres (20.7 percent) of the Planning Area. The low-sensitivity zone has a cultural resource density of one site per 538 acres and encompasses 81,215 acres (64 percent) of the Planning Area.

3.4.2.6 Use Allocations

A basic management goal is to preserve and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations (BLM Information Bulletin No. 2002-101). The categories of cultural resource use allocations include: (a) scientific use; (b) conservation use; (c) traditional use; (d) public use; (e) experimental use; and (f) discharged from management. The use allocations recommended for the 429 known prehistoric and historic sites are presented in Table 3.4.6 and described below.

Table 3.4.6 Recommended BLM Use Categories by Cultural Resource Site Type

	Prehistoric Sites				*Historic Sites*									
Use Category	***Isolate***	***Lithic Scatter***	***Open Camp***	***Other***	***Isolate***	***Habitation***	***Ranch***	***Mining***	***Transportation***	***Water Control***	***Aspen Art***	***Artifact Scatter***	***Other***	***Total***
Scientific [1]	0	3	28	3	0	1	0	1	0	0	0	0	1	**37**
Conservation	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Traditional Use	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
Public [1]	0	0	0	0	0	1	1	2	2	5	0	0	0	**11**
Experimental	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Discharged from Management	0	0	4	0	0	0	0	0	0	0	0	0	0	**4**

Note:
[1] One site is included in both the scientific and public use categories.

No Allocation

A total of 378 sites were not allocated to any use because insufficient information is available to make an informed recommendation. Many of the known sites are considered ineligible for nomination to the NRHP. As such, these properties may be candidates for discharge from a management category. However, due to the lack of understanding of the Holocene stratigraphy, and the lack of information in the management area, it is difficult to determine if these properties have additional buried expressions. It is recommended that these properties be reevaluated whenever possible before assigning use allocations.

Scientific Use

Sites in this category are most likely to yield significant archaeological information about the prehistory and history of the region. The method of use is generally archaeological excavation, controlled surface collection, and/or controlled recordation (data recovery). These sites may require long-term preservation and management and will constrain other land uses by necessitating avoidance of ground disturbing activities until their scientific potential has been realized. Of the 37 sites allocated to this use category, 23 are eligible for the NRHP, and 13 require additional scientific study before their significance can be determined. These sites were judged to have strong research potential based on the information presented in the site forms and their linkage to applicable research questions.

Conservation for Future Use

This category is reserved for any unusual cultural property that, because of scarcity, a research potential that surpasses the current state-of-the-art, singular historic importance, cultural importance, architectural interest, or comparable reasons, is not currently available for consideration as the subject of scientific or historical study. A cultural property included in this category is deemed worthy of segregation from all other land or resource uses. No sites have been allocated to this use category.

Traditional Use

This category is applied to any cultural resource perceived by a specified social and/or cultural group as important in maintaining the cultural identity, heritage, or well-being of the group. Cultural properties assigned to this use are to be managed in ways that recognize the importance ascribed to them and seek to accommodate their continued traditional use. One specific site has been allocated to this use category.

Public Use

This category may be applied to any cultural property found to be appropriate for use as an interpretive exhibit in place, or for related educational and recreational use by members of the general public. Eleven sites are recommended for allocation to this use category.

Experimental Use

This category may be applied to a cultural property judged well-suited for controlled experimental study, which may result in the property's alteration including the possible loss of integrity and destruction of its physical elements. The studies should aim toward understanding the kinds and rates of natural or human-caused deterioration, testing the effectiveness of protection measures, or developing new research or interpretive methods and practical management information. It should not be applied to cultural properties with strong research potential, traditional cultural importance, or good public use potential if doing so would significantly diminish those uses. No sites are recommended for allocation to this use category. However, any site determined not eligible for nomination to the NRHP by the BLM and Colorado State Historic Preservation Office (SHPO) should be considered for possible placement in this category at a future date.

Discharged from Management

This category is assigned to cultural properties that have no remaining identifiable use. These are generally prehistoric and historic archaeological properties, such as small surface scatters of artifacts or debris, whose limited research potential is exhausted as soon as they have been documented. This category may also apply to sites whose salient information has been collected through mitigation or research, or sites that have been destroyed by natural or human activities. These sites remain in the inventory, but do not require long-term preservation and management and do not constrain other land uses. They do not require avoidance by surface-disturbing activities. Four sites are recommended for placement in this use category. Their integrity has been completely compromised or artifacts completely collected. All of these sites are completely lacking in integrity. Sites and isolated finds determined as not eligible for nomination to the NRHP may be candidates for placement in this category.

3.4.2.7 Data Gaps

The Class I overview identified a number of data deficiencies in the information that has been collected from previous cultural resources investigations in the Planning Area. These include: (1) lack of information on subsurface character; (2) lack of information on age of the resources; (3) lack of excavation data, including micro and macroflora and fauna, technology, and paleoenvironment that would help analyze the subsistence and settlement patterns in the area; and (4) a bias in NRHP site evaluations that favors prehistoric sites over historic sites (Hoefer et al. 2002).

3.4.3 Socioeconomics

Information describing the Affected Environment for socioeconomics is revised and updated since the Roan FEIS was completed.

3.4.3.1 Area of Analysis

The socioeconomic impacts of the development alternatives would mostly affect three counties in Colorado. The three-county Study Area includes Garfield County, which contains most of the Planning Area and has a number of established communities; Rio Blanco County, which contains a small part of the Planning Area and one community not too far distant from potential worksites; and Mesa County, a metropolitan area about 50 to 75 miles from the communities closest to the Planning Area that possesses the largest housing stock in the Study Area, the most diverse business community, and strong transportation linkages that have been serving Garfield County oil and gas operators and their suppliers over the past decade.

Public revenues generated by the development alternatives would affect almost all of Garfield County's taxing jurisdictions, most of which have come to rely heavily on that income. Some revenue has the potential to accrue to Rio Blanco County government, though the amount would be much less than Garfield County because so little of the Planning Area (720 acres out of 126,890) is located within Rio Blanco County. Mesa County public revenue impacts would be indirect (i.e., revenue from secondary economic “ripple” effects generated by activity within the Planning Area). This is because none of the Planning Area, per se, is in Mesa County, so the county cannot directly tax the potential new oil and gas facilities and production.

Less tangible effects of the development alternatives are potentially widespread. Many people in Colorado, locally, across the State, and even in the United States as a whole, know of and make use of resources in the Planning Area. This kind of potential effect would occur primarily because of attachments formed through the direct experience of the area, or perhaps knowledge of the area at a distance. Local experience and knowledge of the area may affect community attitudes regarding quality of life.

3.4.3.2 Population

Since 1990 and continuing through 2013, Garfield County's population growth has been shifting to the western part of county. In 2010, 55 percent of Garfield County's population was in its western portion, up from 53 percent in 2000 and from 50 percent in 1990. The western part of Garfield County includes the communities of New Castle, Silt, Rifle, Parachute, and Battlement Mesa, and it contains almost all of the county's oil and gas development.

The eastern part of Garfield County, anchored by Glenwood Springs and Carbondale, is farther from the oil and gas fields of western Garfield County. Eastern Garfield County is more heavily influenced by socioeconomic trends related to locally available tourism and recreation resources and those in Pitkin County to the south (containing the Aspen area ski resorts) and Eagle County to the east (containing the Beaver Creek and Vail ski resorts).

Population

Table 3.4.7 presents population data for the three counties in the Study Area for the period from 2000 to 2010. Overall, Garfield County's population grew to about 56,000 in 2010 from about 44,000 in 2000, or 29 percent. At the same time, Mesa County's population grew to about 147,000 in 2010 (up 26 percent from 2000), and Rio Blanco County's population grew to about 7,000 (up 11 percent).

Table 3.4.7 Population Change in the Study Area from 2000 to 2010

Population Area	*2000*	*2010*	*10-Year Change*	*Average Annual Change*
Garfield County	43,791	56,389	28.8%	2.6%
Colorado River Valley and Roan Plateau (from New Castle west)	23,009	31,115	35.2%	3.1%
Western Communities				
Rifle	6,784	9,172	35.2%	3.1%
Battlement Mesa	3,497	4,471	27.9%	2.5%
Parachute	1,006	1,085	7.9%	0.8%
New Castle	1,984	4,518	127.7%	8.6%
Silt	1,740	2,930	68.4%	5.4%
Balance of western CCDs	7,998	8,939	11.8%	1.1%
Roaring Fork Valley Area (Glenwood Springs CCD)	20,782	25,274	21.6%	2.0%
Eastern Communities				
Carbondale	5,196	6,427	23.7%	2.2%
Glenwood Springs	7,736	9,614	24.3%	2.2%
Balance of Glenwood Springs CCD	7,850	9,233	17.6%	1.6%
Mesa County	116,255	146,723	26.2%	2.4%
Rio Blanco County	5,986	6,666	11.4%	1.1%
Three-County Region	166,032	209,778	26.4%	2.4%
Colorado	4,301,000	5,029,000	16.9%	1.6%

Table 3.4.7 Population Change in the Study Area from 2000 to 2010

Population Area	*2000*	*2010*	*10-Year Change*	*Average Annual Change*

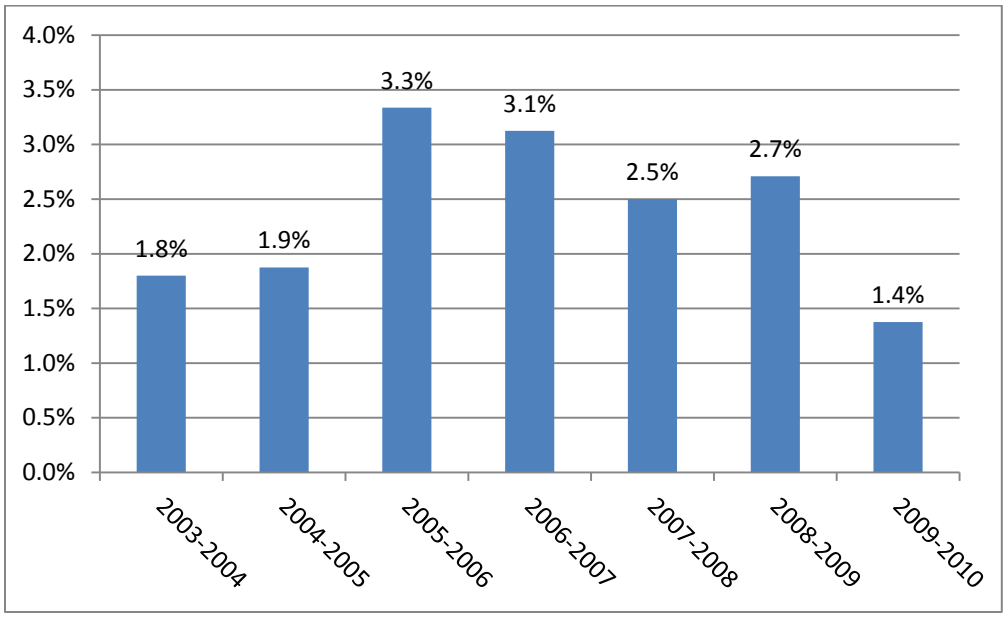
Sources: U.S. Census Bureau 2000, 2010a.

Note: Calculations by Lloyd Levy Consulting, LLC.

Key:
CCD = Census County Division

Attractive economics and new technologies created a "gas boom" affecting the three-county region (Garfield County 2013d). Figure 3.4-1 illustrates the rise and fall of population growth rates during this period.

Table 3.4.8 presents population estimates for 2010 and 2013 for the three-county region and selected communities of Garfield County. Even by growing at generally less than one percent per year from 2000 to 2013, western Garfield County has continued to grow more quickly since 2000 than eastern Garfield County.



Source: State of Colorado 2015a.
Note: Calculations by Lloyd Levy Consulting, LLC.

Figure 3.4-1 Year over Year Percentage Growth 2003 to 2010 of Total Population in the Three-County Region (Garfield, Mesa, and Rio Blanco Counties)

Table 3.4.8 Population Estimates and Population Change in Garfield, Mesa and Rio Blanco Counties and Selected Garfield County Communities from 2000 to 2013

Population Area	*2010*	*2013*	*Average Annual Change from 2010 to 2013*
Garfield County	56,150	57,298	0.7%
Mesa County	146,587	147,811	0.3%
Rio Blanco County	6,617	6,778	0.8%
Communities			
Battlement Mesa	4,967[a]	4,950[b]	-0.1%
Glenwood Springs	9,571	9,849	1.0%
New Castle	4,495	4,563	0.5%
Parachute	1,080	1,095	0.5%
Rifle	9,133	9,279	0.5%
Silt	2,915	2,988	0.8%

Source: State of Colorado 2015b, except as noted.

Notes:
[a] U.S. Census Bureau 2010b.
[b] Estimate by Lloyd Levy Consulting, LLC.

Population growth in each county of the three-county region from 2010 to 2013 has been slower than the average calculated over the previous decade, as calculated from population estimates in July of each year (State of Colorado 2015a). Average annual population growth in Garfield County from 2010 to 2013 has been about 0.7 percent per year compared to about 2.4 percent from 2000 to 2010, about 0.3 percent per year in Mesa County compared to about 2.2 percent from 2000 to 2010, and about 0.8 percent per year in Rio Blanco County compared to about 1.0 percent per year from 2000 to 2010.

Demographics

Table 3.4.9 presents a demographic profile of the three-county region and selected communities of Garfield County in 2013.

Table 3.4.9 Demographics of the Three-County Region and Selected Communities in 2013

Population Area	*Median Age*	*< 18*	*65+*	*Minority Race [a]*	*Hispanic [b]*
Colorado	36.1	24.0%	11.4%	16.0%	20.8%
Garfield County	35.1	26.7%	9.0%	9.7%	28.2%
Mesa County	38.2	23.2%	15.4%	8.6%	13.5%
Rio Blanco County	38.0	23.5%	13.0%	5.1%	10.8%
Communities					
Battlement Mesa	34.7	31.3%	14.2%	5.7%	23.6%

Table 3.4.9 Demographics of the Three-County Region and Selected Communities in 2013

Population Area	*Median Age*	*< 18*	*65+*	*Minority Race* [a]	*Hispanic* [b]
Glenwood Springs	35.3	19.2%	10.4%	12.2%	26.2%
New Castle	29.6	32.9%	6.4%	4.3%	33.6%
Parachute	30.5	32.7%	5.5%	13.7%	34.1%
Rifle	32.8	28.0%	7.4%	6.3%	26.4%
Silt	27.8	31.5%	5.7%	18.3%	35.7%

Source: U.S. Census Bureau 2013a.

Notes:
[a] All races and combinations except white-alone. May include Hispanic persons choosing "some other race."
[b] Hispanic or Latino of any race.

In terms of median age (the age where 50 percent of the population is older and 50 percent is younger), Garfield County stayed younger than the State as a whole from 2000 to 2010, with the underlying change due to migration and the related natural effect of births minus deaths. The pattern of population age varies across Garfield County, with almost all communities in western Garfield County (New Castle, Silt, Rifle, and Parachute) being substantially younger in 2013 than the county as a whole. The median age in Battlement Mesa (the unincorporated community near Parachute) fell to 35 years in 2010 from 40 in 2000. However, it is still higher than the county wide median age of 31, despite trending away from being a place predominantly for retirement.

The median age in Mesa County and Rio Blanco County (including the town of Meeker in Rio Blanco County) was 38 years in 2013, higher than Colorado as a whole as shown in Table 3.4.9. Rangely, located in Rio Blanco County, is an exception; a work force employed by a producing oil field may lower the median age, which is 31 years in Rangely.

At 28 percent, the share of persons in Garfield County identifying as Hispanic (of any race) stands out as higher than Mesa and Rio Blanco counties or the State of Colorado as a whole (Table 3.4.9). The Hispanic share of the population increased between 2000 and 2010 in all three counties of the Study Area and in Colorado. However, the rise in share in Garfield County was greater than the other counties or Colorado as a whole. Persons identifying as of a minority race (including persons choosing "Hispanic" as their race) also increased more in Garfield County from 2000 to 2010 than in the other two counties or Colorado. Hispanic representation is strong in almost every community in Garfield County. Section 3.4.3.12 presents minority populations at the block group level to comply with the environmental justice executive order (Executive Order 12898).

Household Income and Poverty

Colorado's median household income was $58,400 in 2013 and the population poverty rate was about 13 percent (Table 3.4.10). Comparison to this benchmark indicates the relative economic standard of living of these populations in the Study Area and in communities near the Planning Area. The median household income of Mesa County as a whole and of the communities of Rifle and Silt are lower than 90 percent of the State median. The median income of Parachute is notable for being about 60 percent of the State median. Only Glenwood Springs has a poverty percentage well above the State average, and this relationship is qualified by the fact that the poverty statistic for Glenwood Springs has a high margin of

error; therefore, it is uncertain that this number reflects the true poverty rate in 2013. Section 3.4.3.12 presents low-income populations at the block group level (U.S. Census Bureau 2010c; U.S. Census Bureau 2013c), to comply with the environmental justice executive order (Executive Order 12898).

Table 3.4.10 Household Income and Poverty in the Three-County Area and Selected Communities in Garfield County, 2013

Population Area	*Median Household Income*	*Median Household Income as Percent of State Median*	*Percent of Population in Poverty* [a]
Colorado	$58,433		13.2%
Garfield County	$57,022	98%	11.9%
Mesa County	$49,471	85%	14.7%
Rio Blanco County	$60,128	103%	*14.9%*
Communities			
Battlement Mesa	$69,120	118%	*8%*
Glenwood Springs	$53,687	92%	*19%*
New Castle	$54,255	93%	*9%*
Parachute	$36,000	62%	*15%*
Rifle	$51,998	89%	*10%*
Silt	$50,865	87%	*14%*

Source: U.S. Census Bureau 2013b.

Note:
[a] Percentages in italics have a high margin of error.

Occupational Profile and Oil and Gas Industry Affiliation

Table 3.4.11 is an occupational profile of the resident population in the three-county region and the U.S. Census Bureau county divisions (CCDs) of Garfield County in 2013. Two categories (natural resources, construction and maintenance operations; and production, transportation and material moving occupations) are industrial and are likely to be associated with the oil and gas industry in the Planning Area. An above-average concentration in these occupations indicates a strong association with the industry. On that assumption, the occupational profile in all three counties suggests a tendency for residents to be employed in the oil and gas industry, with the Rio Blanco County profile suggesting the strongest tendency. The occupational profiles of the western CCDs of Garfield County (Rifle and West Garfield CCDs, which encompass the communities of Rifle, Parachute, and Battlement Mesa and surroundings) also suggest a tendency for residents to be employed in the oil and gas industry and stronger than is found in the occupational profiles of the eastern CCDs of the county (Glenwood Springs and New Castle CCDs).

Table 3.4.11 Occupational Profile in 2013 of the Three-County Area and of the Census County Divisions in Garfield County

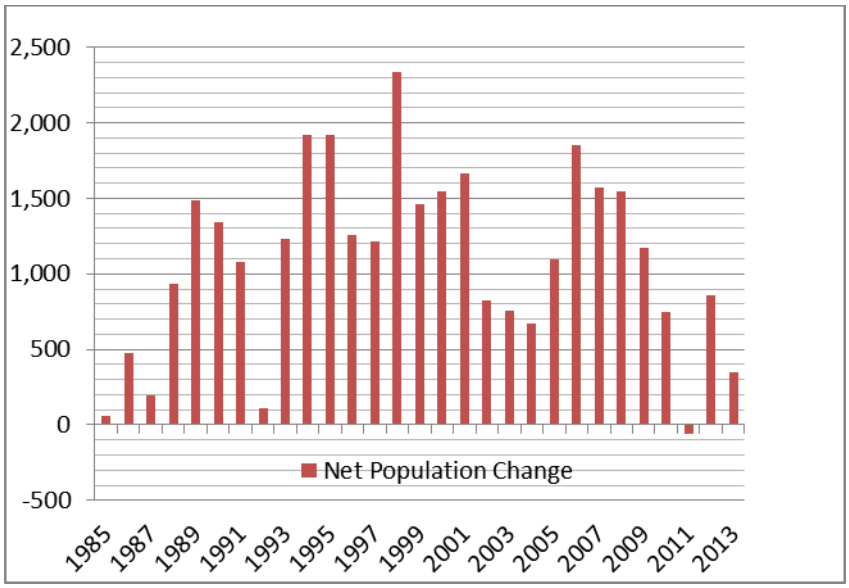
Occupation	*Colorado*	*Garfield County*	*Mesa County*	*Rio Blanco County*	*Garfield County Census County Divisions (CCD)*			
					Glenwood Springs CCD	*New Castle CCD*	*Rifle CCD*	*West Garfield CCD*
Management, business, science, and arts occupations	39.9%	28.0%	32.3%	24.8%	22.6%	29.5%	18.1%	21.3%
Service occupations	17.3%	18.4%	17.9%	17.5%	20.9%	16.0%	11.2%	19.1%
Sales and office occupations	24.4%	24.2%	25.5%	19.2%	16.2%	26.6%	27.8%	27.5%
Natural resources, construction, and maintenance occupations (a)	9.4%	19.7%	12.7%	19.2%	6.8%	19.7%	28.6%	16.1%
Production, transportation, and material moving occupations (b)	9.0%	9.6%	11.6%	19.4%	23.0%	8.2%	14.2%	16.0%
Sum of industrial occupations (a + b)	18.4%	29.3%	24.3%	38.6%	29.8%	27.9%	42.8%	32.1%

Source: U.S. Census Bureau 2013b.

Population and Labor Force Mobility

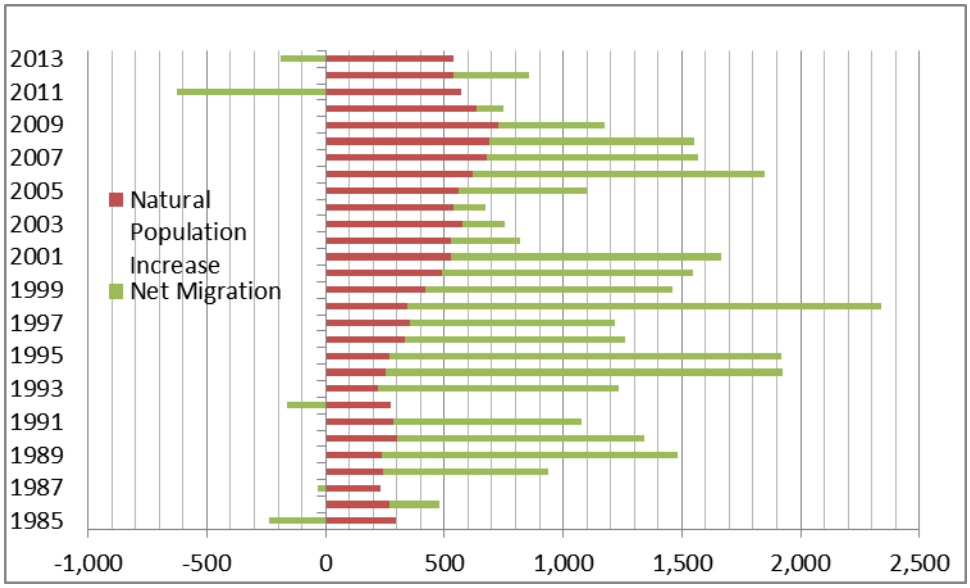
The population and labor force of the three-county Study Area have been highly mobile, both in moving from residences, especially in response to employment opportunities, and in commuting large distances to work in response to job availability, pay level, and the cost of living, especially housing.

Net migration has been a substantial but variable contributor to population in the three-county area. The variability is evident in Figures 3.4-2 through 3.4-7. The series of figures first illustrates the total annual population change in Garfield, Mesa, and Rio Blanco counties, and then illustrates the breakdown of total population change into its two components, natural increase and net migration. The figures present data for 29 periods of year-to-year change from 1985 to 2013.



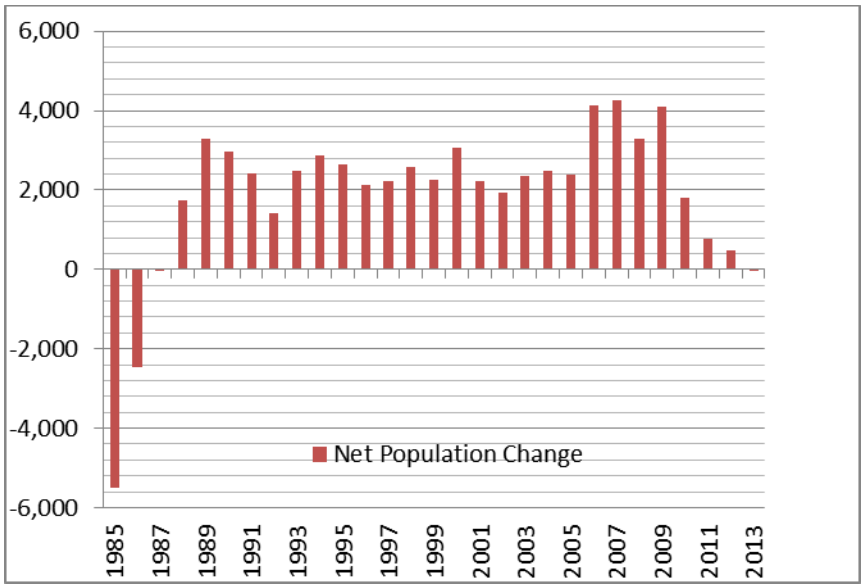
Source: State of Colorado 2015a.

Figure 3.4-2 Annual Population Change in Garfield County from 1985 to 2013



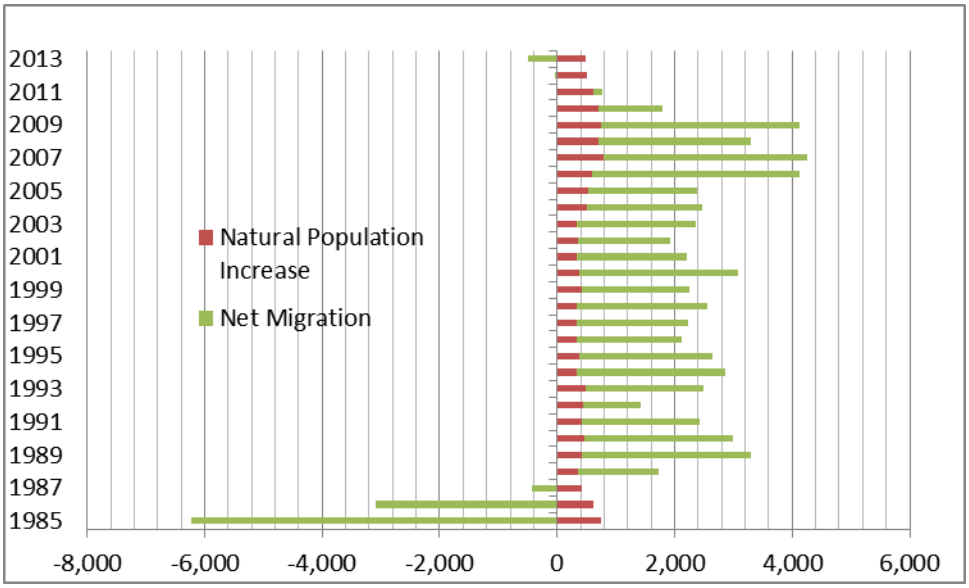
Source: State of Colorado 2015a.

Figure 3.4-3 Natural Increase and Net Migration Components of Population Change in Garfield County from 1985 to 2013



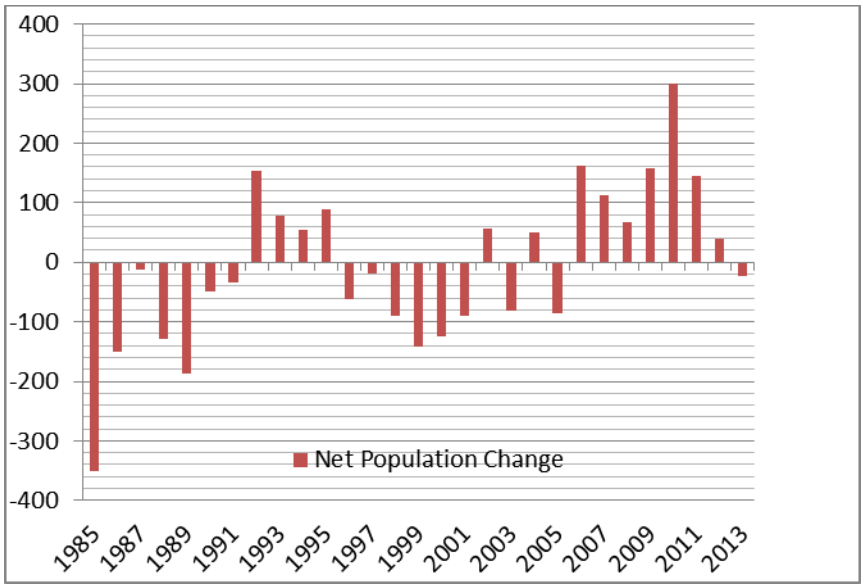
Source: State of Colorado 2015a.

Figure 3.4-4 Annual Population Change in Mesa County from 1985 to 2013



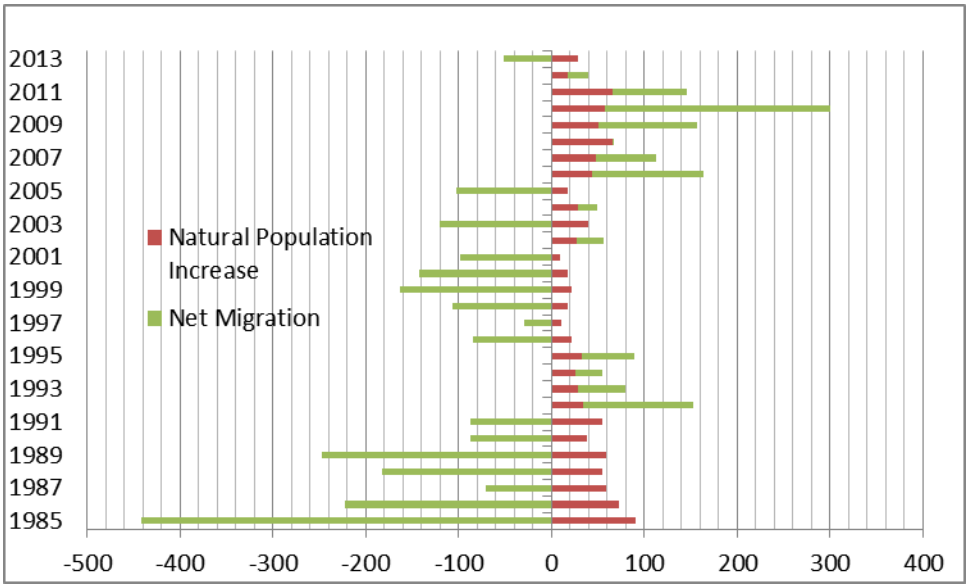
Source: State of Colorado 2015a.

Figure 3.4-5 Natural Increase and Net Migration Components of Population Change in Mesa County from 1985 to 2013



Source: State of Colorado 2015a.

Figure 3.4-6 Annual Population Change in Rio Blanco County from 1985 to 2013



Source: State of Colorado 2015a.

Figure 3.4-7 Natural Increase and Net Migration Components of Population Change in Rio Blanco County from 1985 to 2013

Figures 3.4-2 through 3.4-7 demonstrate that net migration (people moving in, minus people moving out) has usually been a larger contributor to annual population change in the three-county region than natural increase (births minus deaths). The figures also illustrate how populations for these counties can suddenly fall under adverse conditions due to net out-migration (busts) or suddenly rise when conditions are favorable (booms).

Finally, the figures show that the year-to-year change in population in Rio Blanco County has been especially variable because of net migration, with 16 of the last 29 years having been years of net population loss and the years since 2006 having been years of relatively large population gain due to net in-migration. In Garfield and Mesa counties, population has generally risen year over year during the period illustrated in the figures, though Mesa County's estimated population declined by a small percentage from 2012 to 2013. For Garfield and Mesa counties, years of strong versus weak conditions likely affect the amount of annual growth and do not to create annual rises and falls, as seen for Rio Blanco County.

It is also clear from the figures that the amount of annual net migration in Garfield, Mesa, and Rio Blanco counties relates closely to economic changes occurring from year to year. This linkage had the expected effect in recent years as the oil and gas industry in the three-county region grew, declined, and then stabilized.

Employment within the three-county area triggers a substantial labor force commuting from residences to work sites. Commuting data for 10 recent years also show that the oil and gas industry in the three-county region substantially affects commuting from year to year. Commuting flows are generally large compared to the size of the labor force and employment in Garfield and Rio Blanco counties. In absolute numbers, commuters flow in and out of Garfield and Mesa counties at a similar level. While the numbers of Rio Blanco County in- and out-commuters are low, they are a large fraction of the county's small population, labor force, and job levels. These measurements are limited to workers commuting to their primary job (i.e., the job from which the worker earns the most).

In 2011 (the most recent year of estimates), Garfield County saw 46 percent of the resident labor force working outside the county and 38 percent of the jobs located in the county being held by non-residents. In Mesa County, 21 percent of the resident labor force commuted out for primary jobs, and 21 percent of jobs in the county were held by in-commuters. In Rio Blanco County, 39 percent of residents holding primary jobs commuted out, and 44 percent of jobs in the county were held by in-commuters.

Observations available from 2002 to 2011 show that net commuter flows in all three counties changed as the level of oil and gas activity changed. From 2002 to 2005, as oil and gas activity grew, Garfield County had a net commuter outflow of 24 to 27 percent; from 2006 to 2011 Garfield County's net commuter outflow was reduced to 20 percent or less, with a low net outflow of 10 percent in 2009. From 2002 to 2011, Mesa County had net commuter inflows, except for small commuter outflows in 2006 to 2008, the years during which oil and gas activity increased to a peak in Garfield County (U.S. Census Bureau 2014).

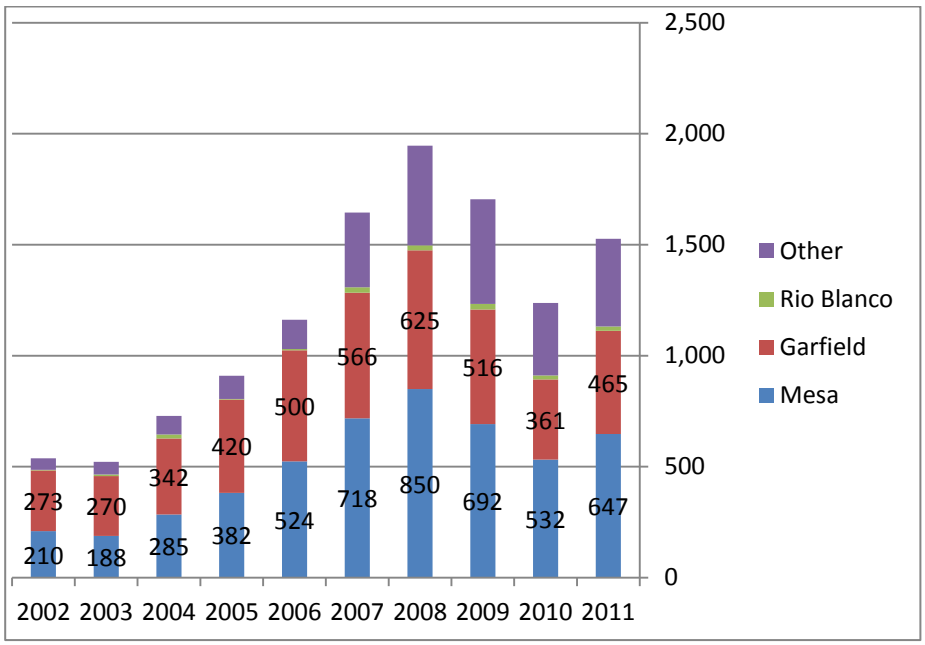
Oil and gas development influences the breadth of the labor market by attracting workers from a wide geographical area. Observations on that pattern come from examining the in-commuting activity of workers to a small sub-area of Garfield County, which was selected for being about the same location as the Planning Area. This analysis shows that the jobs, the majority of which are likely to be oil and gas related, are held not just by residents of Garfield and Mesa counties, but also by residents of many other Colorado counties and even by residents living outside of Colorado. In-commuters from Rio Blanco County notably represent a small number and percentage.

Between 2007 and 2011, with oil and gas employment at peak or high levels, 41 to 44 percent of private primary jobs in the Planning Area were held by reported residents of Mesa County, 29 to 34 percent were held by residents of Garfield County, and 20 to 28 percent were held by residents of other Colorado counties and places outside of Colorado. Rio Blanco County residents were always around one percent of job holders in the Planning Area during this time frame. Figures 3.4-8 and 3.4-9 illustrate the trends with information from 2002 to 2011.

The data for Figures 3.4-8 and 3.4-9 were selected from the smallest U.S. Census Bureau geographical area that includes the Planning Area. The data also include just "private primary jobs," which are the highest paying, non-government jobs held by a worker in the data. Given these specifications, the figures should indicate the pattern of residential location that occurred due to oil and gas development and production activity within, or in the immediate vicinity of, the Planning Area during a period of heavy oil and gas activity.

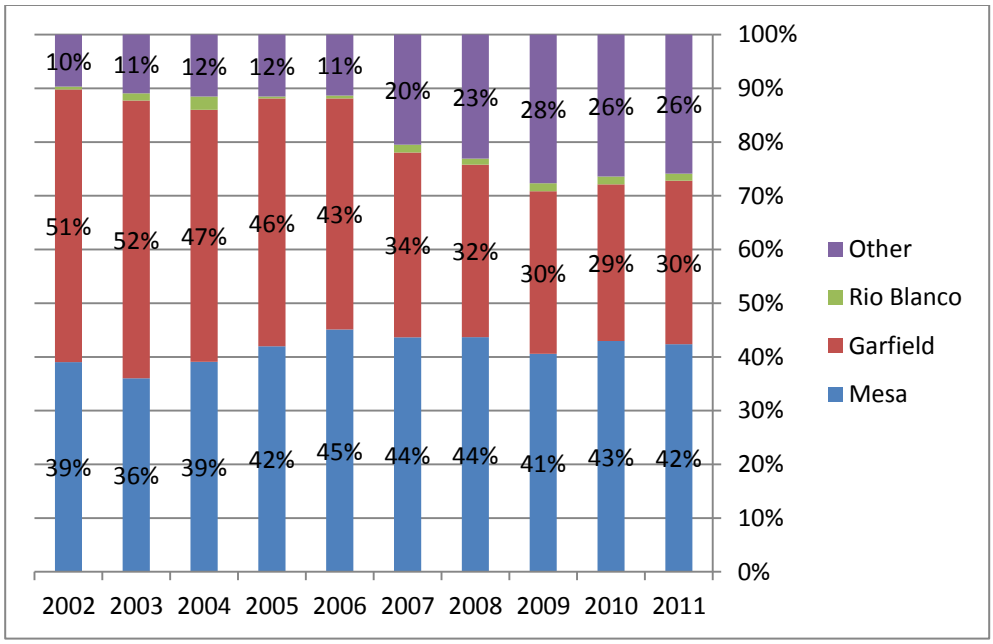
3.4.3.3 Housing

Table 3.4.12 presents a profile of housing and households in the three-county region and selected communities in 2013. These estimates show an above-the-State-average rate of rental vacancy in Garfield County and Rio Blanco County and an average rental vacancy rate for Mesa County. A rough approximation of the number of rental units available, based on the estimates of total housing units, are 1,600 in Garfield County, 1,900 in Mesa County, and 300 in Rio Blanco County. Parachute has a high rental vacancy rate, though this translates into only approximately 130 units in a small town. The higher than average vacancy rate for Rifle shown in the table translates into approximately 250 vacant rental units. The total for Parachute and Rifle is 380 vacant rental units. The estimated number of total housing units for the unincorporated Battlement Mesa subdivision was more than 2,100 units in 2013, but an estimate of vacancy was not available.



Source: U.S. Census Bureau 2014.

Figure 3.4-8 Number of Private Primary Job Holders Working In and Near the Planning Area by County of Residence, 2002 to 2011



Source: U.S. Census Bureau 2014.

Figure 3.4-9 Percentage of Private Primary Job Holders Working In and Near the Planning Area by County of Residence, 2002 to 2011

Table 3.4.12 Profile of Housing and Households in 2013 for the Three-County Region and Selected Communities and Sub-Areas

Population Area	*Total Housing Units*	*Persons per Household*	*Gross Vacancy Rate*	*Estimate of Vacant by Type* [b]			*Median Local Shelter Cost as % of Median County Income 2013 (both owned and rented housing)*[c]
				Vacant for Rent	*Vacant for Sale*	*Other Vacant*	
Colorado		2.49	8%	3%	2%	3%	24%
Garfield County	23,489	2.73	12%	7%	2%	2%	28%
Mesa County	63,802	2.46	9%	3%	2%	3%	24%
Rio Blanco County	3,353	2.43	20%	10%	3%	7%	15%
Communities							
Battlement Mesa	*2,137*[a]	NA	NA	NA	NA	NA	24%
Glenwood Springs	4,176	2.50	7%	4%	1%	3%	29%
New Castle	1,719	2.88	8%	4%	3%	1%	33%

Table 3.4.12 Profile of Housing and Households in 2013 for the Three-County Region and Selected Communities and Sub-Areas

Population Area	Total Housing Units	Persons per Household	Gross Vacancy Rate	Estimate of Vacant by Type [b]			Median Local Shelter Cost as % of Median County Income 2013 (both owned and rented housing)[c]
				Vacant for Rent	Vacant for Sale	Other Vacant	
Parachute	539	2.93	31%	26%	3%	2%	21%
Rifle	3,635	2.81	10%	7%	2%	1%	25%
Silt	1,088	2.97	8%	3%	2%	2%	27%

Source: U.S. Census Bureau, 2010 except as noted.

Notes:
[a] U.S. Census Bureau 2013a.
[b] Estimates by Lloyd Levy Consulting based on U.S. Census Bureau 2010.
[c] U.S. Census Bureau 2013c.

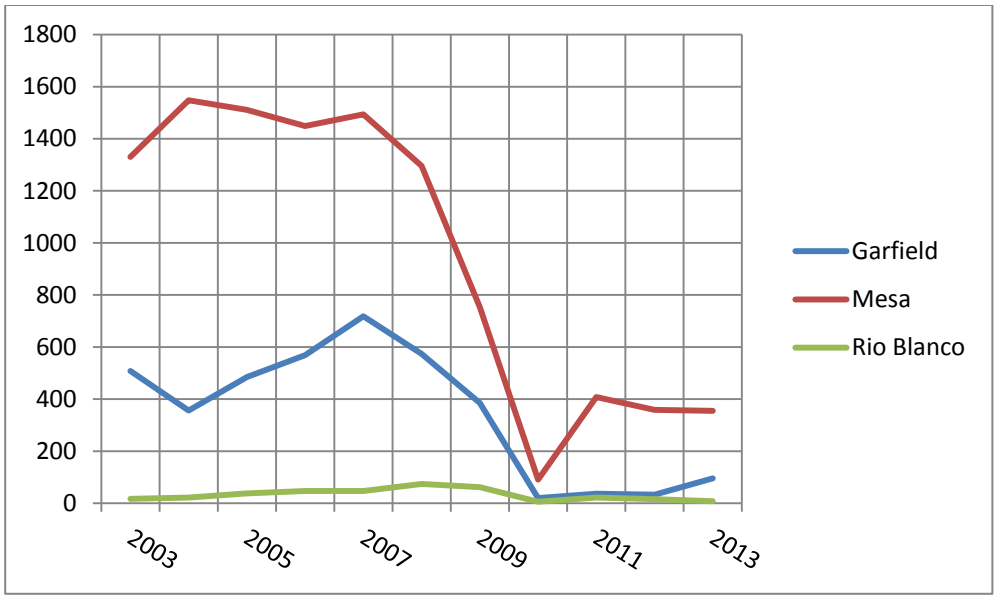
Key:
NA = There is no source for these statistics for Battlement Mesa.

Housing affordability (i.e., the median shelter cost in a locality expressed as a percentage of median county-wide household income) ranges from higher affordability in Rio Blanco County (where the percentage was below the State average) to lower affordability in Garfield County as a whole. Affordability in Mesa County as a whole is average compared to the State as a whole. The data in Table 3.4.12 above also show that housing was more affordable in western Garfield County in 2013 than in eastern Garfield County, with Silt, Rifle, and especially Parachute more affordable (lower percentages) than the overall Garfield County average.

These approximations of vacancy and affordability provide an indication of the capacity at a point in time to accommodate renter households and to house middle income families, such as those in the oil and gas industry. However, housing conditions change quickly in response to influences from national and local economic conditions and specifically from the activity of the oil and gas industry in the three-county region.

The residential construction industry in the three-county area has been responsive to changing conditions over time, though the scale of activity is small in Rio Blanco County compared to Garfield and Mesa counties, as shown in Figure 3.4-10. The rise and fall in net residential permits issued in Garfield County for the years 2004 to 2010 and in Mesa and Rio Blanco counties from 2003 to 2010 generally correspond to local recognition of a drilling boom (Garfield County 2012b, 2013d).

From 2005 to 2008, Garfield County saw many of its hotel rooms rented as temporary lodging. Glenwood Springs has the majority of hotel rooms in Garfield County; they traditionally serve the travel and tourism market. However, demand in the western part of the county spread to Glenwood Springs during the gas boom. The gas boom also triggered construction of new hotels in the county west of Glenwood Springs. These have added temporary housing capacity. A Google search conducted in February of 2015 returned three hotels in Parachute, nine hotels in Rifle and Silt, and one hotel in New Castle. There are no hotels in De Beque, but hotels in parts of eastern Mesa County are within commuting distance of the Planning Area.



Source: State of Colorado 2015a.

Figure 3.4-10 Net Residential Building Permits in Three-County Region, 2003 to 2013

Temporary Employee Housing Facilities

The Garfield County Land Use Code permits major, minor, and "small" temporary employee housing facilities. One or more of these types have been in use by local industries for field workers. During the drilling boom, this somewhat mitigated the demand for hotel occupancy, recreational vehicle sites, and the unauthorized use of public land for temporary residency. Companies may use onsite temporary housing for employees or subcontractors, but not their dependents, guests, or other family members. Operators must remove temporary employee housing facilities and reclaim the sites at the end of their use (Garfield County 2013b).

3.4.3.4 Facilities and Services

Oil and gas activity in the mid-2000's created rising demand for facilities and services in the unincorporated areas and municipalities across the three-county region. Western Garfield County was a focus of demand. Since activity began to fall in 2008, operating revenues for communities and property taxes for counties have fallen, and jurisdictions have cut or furloughed staff. However, revenue accumulated during the period funded impact assistance payments and reserves for local funding of capital projects. The effect of new capital investment on quality and capacity is apparent in the three-county region and especially in Garfield and Rio Blanco counties.

Assessment

In a 2008 survey in Garfield County, respondents as a whole expressed satisfaction with most facilities and services in the unincorporated area. Facilities and services identified by the survey respondents as in need of improvement were traffic on roads, county road maintenance, and county recycling facilities. Other capital spending identified as a priority included road system improvements, provision of affordable housing, and open space purchase (Garfield County 2008a)

In a 2013 Mesa County survey, 75 percent of respondents with an opinion rated the overall quality of services provided by the county government as “excellent,” “very good,” or “good.” Twenty-two percent

rated the overall quality of county services as “fair” or “poor.” Asked to rate the importance of Mesa County government’s future efforts, the following items were rated very important: promoting public safety (54 percent), creating a community where individuals and families have opportunities to be self-sufficient (54 percent), and protecting and managing all public resources (54 percent). Items rated very important by the fewest respondents were: providing parks outside of cities and towns (25 percent) and expanding new sections of Riverfront Trail (34 percent) (Mesa County 2013a).

No comparable survey information that rates facilities and services was available for Rio Blanco County.

Investment

From the onset of the drilling boom, all three counties and the local governments and districts within the counties invested in facilities and services with capacity for immediate needs and to provide capacity for growth. The following summarizes projects initiated since 2005 and now completed or near completion. The focus is on Garfield County government's jurisdiction on and the communities of western Garfield County because of their responsibilities in proximity to the Planning Area.

Garfield County

Beginning in 2005, Garfield County leveraged robust revenue and intergovernmental awards from various sources to invest in upgrading and expanding its facilities. As the economy weakened in 2008 and expectations for future revenues declined, capital investment slowed first to "catch-up" and then to maintenance levels.

However, this was not before completing many projects. A large component of the Garfield County investment program was large annual expenditures on roads and bridges in response to expenses related to usage by the oil and gas industry and a growing population. Two large projects included rebuilding County Road 204 north of De Beque (Roan Creek Road) and a new I-70 interchange at Parachute.

A three-year project to upgrade the Garfield County Airport for general aviation jet traffic was completed in 2011. New buildings constructed since 2005 include a justice center in Rifle jointly housing the courts and the Rifle police, a community corrections facility and sheriff's annex in Rifle, a public health and human services annex in Rifle, a remodel of the county jail in Glenwood Springs, and an airport operations center. The county also expanded landfill capacity with a new cell. Garfield County acquired land for a new office building in Glenwood Springs but postponed the project as economic activity slowed and revenues declined. Affordable housing projects in Rifle and Carbondale were programmed but were never launched (Garfield County 2005, 2006, 2007, 2008b, 2009, 2010, 2011, 2012b, 2013a).

Rifle

Rifle broke ground on a new water treatment plan in 2014 (Rice 2013). Other recently completed improvements include a city park and the conversion of a movie theater into a cultural center. A new wastewater treatment plant began operating in December 2009. The budget for city street improvements continued to be stressed in 2014, and there was no spending from the capital improvements fund proposed for 2015 (City of Rifle 2014, 2015).

Parachute

Parachute has experienced revenue shortages for water and wastewater utilities. Parachute funded a utilities master plan update and expects to install water meters for better management and cost effectiveness. The 2015 budget maintains current service levels and begins a return to adequate funding for street maintenance (Town of Parachute 2013a, 2014).

Battlement Mesa Planned Unit Development

The county and a variety of special districts and homeowners associations currently provide public services to the planned unit development subdivision of Battlement Mesa (BBC 2010). This unincorporated community is located across the Colorado River from Parachute approximately 5 miles from the Planning Area. Garfield County encourages locating infill and additional development in Battlement Mesa because of the urban infrastructure and services provided there (Garfield County 2013c).

Silt

Silt's 2011 comprehensive plan reflected adequate existing infrastructure in the city and reinforced a goal of encouraging compact growth from the inside out, starting at the town's "core." City needs include improved streets, sidewalks, and shopping for convenience and revenue generation (Town of Silt 2011).

New Castle

Water plant improvements in 2009, funded by a voter-approved bond issue and property tax, addressed limits to treatment capacity during spring runoff. The project relieved the bottleneck and expanded the plant's nominal capacity to produce treated water by about 50 percent. New Castle expanded wastewater treatment facilities in 2009 and sized the plant to serve existing development and undeveloped land within the town limits, expecting to extend the useful life by 20 years (Town of New Castle 2009).

Mesa County

At the end of 2013, Mesa County reported having a multi-year infrastructure improvement plan in place funded by certificates of participation issued in 2010. Mesa County projected adequate ongoing revenue or backup reserve balances to service the debt. Recent capital projects include a transit maintenance facility, a training facility, a public works facility, a central services building, sheriff's office remodeling, a new workforce center, trail construction, and numerous road and bridge projects (Mesa County 2013b).

De Beque

De Beque's wastewater treatment plant had unused capacity in 2009. Development of the Blue Stone Ridge Ranch planned unit development located away from the town center includes plans for a regional sewer plant. In the interim, existing facilities could serve the planned unit development by installing a lift station. The service area of De Beque's water system is limited to the area it can serve by gravity flow, and the town considers proposals above the boundary on a case-by-case basis (Town of De Beque 2009).

Rio Blanco County

Rio Blanco County's Impact Fee Trust Fund had a balance of $2.4 million in 2012, down from $5.4 million in 2011 because of costs incurred for road construction projects. The county earmarks impact fees for administration, law enforcement, and road and bridge work. Recent road spending has focused on County Road 5, and Piceance Creek Road, which accesses oil and gas production. The county charges impact fees on new development including oil and has used the funds as a match for grants from the Colorado Energy Impact Assistance Fund (Rio Blanco County 2012).

Meeker

In 2006, the town of Meeker's five existing wells were near capacity for a 10-year planning horizon. The remedy would be to drill one or two new wells, and the town has the water rights to make this possible (Town of Meeker 2006, 2008). The Meeker Sanitation District serves Meeker and a handful of properties immediately outside of the town limits. Usage of 60 percent in 2006 indicated that the district would have the capacity to serve Meeker for the foreseeable future (Town of Meeker 2006). Trends have weakened since these assessments.

3.4.3.5 Employment, Earnings, and Personal Income

For the purposes of this analysis, the BLM uses definitions established by the U.S. Bureau of Economic Analysis for employment and earnings (USDC 2015). Employment is the average number of full-time and part-time jobs reported monthly over an entire year (also referred to as "annual average jobs" in this SEIS). Earnings includes total payroll cost of employees, including such payments as wages, salaries, bonuses, health insurance and other benefits, retirement contributions, and payroll taxes. The most recent year for which complete employment and earnings data are available, and therefore the base year for this analysis, is 2013.

Mesa County is the only Metropolitan Statistical Area (MSA) in western Colorado. An MSA is an economic center with at least one densely-settled urban area of 50,000 or more people (OMB 2013). The notion of an economic center is defined as an area of high employment accompanied by commuting from surrounding areas. Garfield County is classified as a Micropolitan Statistical Area (Micro), or an area defined as a non-metro labor-market area centered on urban clusters of between 10,000 and 50,000 persons. There are eight Micro areas in western Colorado, including three along the I-70 corridor between the Eisenhower Tunnel and Mesa County (OMB 2013). Rio Blanco is a non-metro county of less than 10,000 that does not exhibit the "core" economic characteristics of MSAs or Micros.

In 2013, the Study Area hosted 127,000 jobs (3.8 percent of all jobs statewide), with payrolls of over $5.4 billion (2.7 percent of statewide earnings) (USDC 2014). The lower share of statewide earnings compared with employment can be attributed to factors such as a high share of retail and service industries in western Colorado coupled with high incomes in Front Range metro areas that dominate statewide statistics.

Tables 3.4.13 through 3.4.21 show employment and income by county, industry, and year since 2007 (USDC 2014). In most parts of the United States, employment and earnings peaked in or shortly after 2007, then declined during and after the recession of 2007-2009 (NBER 2015). Recovery from the recession has been slow by historical standards, continuing through 2013 for many industries. Across the Study Area, total employment in 2013 remained below the peak in 2008. This suggests that many communities and industries in the Study Area continue to struggle economically in the wake of the national recession.

Tables 3.4.13, 3.4.14, and 3.4.15 provide employment, earnings, and personal income information for Garfield County. Before 2010, construction was the leading employer in Garfield County followed by retail trade, government, and accommodations and food services. A very robust economy was fueled by oil and gas development as well as tourism. By 2010, government became the leading employer followed by construction, retail trade, and accommodations and food service. The emergence of government as a leading employer is often a characteristic of recessionary times as private industries contract. In 2013, the relative rankings of government, construction, retail trade, and accommodations and food service continue as they were in 2010. Construction has weathered the recession better in Garfield County than other parts of the State primarily because of oil and gas development in the area. Mining, the home of oil and gas industries, has been particularly strong in the county throughout this period.

The right-hand column of Table 3.4.13 shows how 2013 employment compares with the highest job total since 2007. Six industries, including government, healthcare, and management/administrative and waste services, reached new highs in 2013. Other industries remain short of previous highs, mostly in 2008. While construction remains a major employer in the county, the industry was at 64 percent of its 2008 high. Overall, employment in the county was 92 percent of the 2008 high. The trend, however, is up since a low in 2010.

Table 3.4.14 shows earnings in Garfield County since 2007. Earnings are expressed as millions of constant 2013 dollars so that comparisons across years exclude the effect of inflation. Many of the patterns exhibited by jobs data are replicated for earnings, including the emergence of government as the largest payroll among all industries in 2010. Since the recession, county-wide earnings have not rebounded as quickly as jobs. As a whole, in 2013, Garfield County employers paid only 84 percent of the previous high payroll in 2008. Industries that have struggled the most during recovery in terms of earnings include construction, real estate, and information services. Those with new highs in 2013 include healthcare, finance and insurance, and utilities.

Table 3.4.15 displays personal income for residents of Garfield County. Personal income is based on place of residence while employment and earnings in the previous two tables are based on place of work. Thus, the earnings component of personal income will not match the earnings presented in Table 3.4.14. In addition to earnings, personal income also includes proceeds from dividends, interest, and rent plus transfer payments from government. Transfer payments include such things Social Security, Medicare, unemployment insurance, and various types of welfare paid by State and local governments. While 2013 earnings lagged behind the 2008 peak, the other components of personal income peaked in 2013. As a whole, personal income for Garfield County residents in 2013 was 90 percent of levels experienced in 2008. Since the low point in 2010, personal income has increased annually.

Tables 3.4.16, 3.4.17, and 3.4.18 provide employment, earnings, and personal income information for Mesa County. Before 2010, retail trade was the leading employer in the county, followed by health care, government, and construction. By 2010, government became the leading employer, followed by health care, retail trade, and accommodations and food service. This pattern is very similar to that of Garfield County. By 2013, health care took over as the largest employer, followed by government, retail trade, and accommodations and food service. Construction has become the fifth largest employer in Mesa County, but has contracted to only 60 percent of its peak size in 2008.

The right-hand column of Table 3.4.16 shows that most industries in 2013 were within 90 percent or more of their previous high. Industries lagging behind were construction and manufacturing. Manufacturing accounts for nearly 4 percent of all jobs in Mesa County, but has recovered to only 81 percent of its 2008 high. Overall, employment in the county was 92 percent of the peak in 2008. The trend is up, however, as evidenced by a modest 1.9 percent increase since the low in 2010.

Table 3.4.13 Employment of Workers in Garfield County by Industry, 2007-2013 (annual average jobs)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Agriculture	931	939	906	923	919	919	925	99%
Mining	2,516	3,240	2,394	2,717	2,779	2,873	2,708	84%
Utilities	212	227	233	221	215	214	228	98%
Construction	6,753	7,157	5,668	4,381	4,198	4,361	4,560	64%
Manufacturing	441	420	338	450	526	532	505	95%
Wholesale trade	967	952	910	864	915	967	1,009	100%
Retail trade	4,579	4,381	3,987	3,682	3,611	3,559	3,676	80%
Transportation and warehousing	1,217	1,188	1,017	857	1,026	986	955	78%
Information	320	303	258	263	250	271	253	79%
Finance and insurance	1,085	1,182	1,281	1,213	1,328	1,266	1,302	98%
Real estate and rental and leasing	2,283	2,719	2,469	2,450	2,525	2,568	2,558	94%
Professional, scientific, and tech services	2,364	2,484	2,301	2,238	2,254	2,257	2,216	89%
Management, administrative, and waste services	2,012	2,027	1,967	2,077	2,057	2,163	2,219	100%
Educational services	421	472	489	504	499	563	571	100%
Health care and social assistance	2,485	2,538	2,589	2,627	2,771	2,847	2,867	100%
Arts, entertainment, and recreation	888	885	887	905	873	923	991	100%
Accommodation and food services	3,176	3,234	2,958	2,740	2,832	2,938	3,031	94%
Other personal services	2,067	2,083	1,994	1,866	1,965	1,987	2,062	99%
Government	4,520	4,967	5,317	5,428	5,401	5,325	5,428	100%
Total	39,237	41,398	37,963	36,406	36,944	37,519	38,064	92%

Source: USDC 2014, Bureau of Economic Analysis, Table CA25N.

Table 3.4.14 Earnings of Workers in Garfield County by Industry, 2007-2013 (millions of 2013 dollars)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Agriculture	3.7	1.7	2.5	0.6	7.2	6.8	9.0	100%
Mining	224.0	305.4	208.8	220.3	241.9	241.4	230.6	76%
Utilities	23.5	25.2	26.0	25.7	25.4	24.9	27.6	100%
Construction	396.7	428.1	336.8	243.9	224.1	229.2	247.7	58%
Manufacturing	28.0	27.8	21.7	21.9	25.6	25.2	21.5	77%
Wholesale trade	59.2	63.3	60.5	56.0	60.1	65.8	67.5	100%
Retail trade	163.2	161.1	141.2	124.5	120.4	119.0	121.8	75%
Transportation and warehousing	75.2	74.4	57.3	49.6	58.2	64.1	59.9	80%
Information	15.7	15.3	12.0	11.3	11.7	11.9	11.0	70%
Finance and insurance	46.2	46.1	46.7	44.3	41.2	45.7	48.0	100%
Real estate and rental and leasing	60.9	70.1	54.2	47.4	50.2	48.9	48.9	70%
Professional, scientific, and tech services	103.8	114.6	97.4	88.7	92.8	99.4	98.8	86%
Management, administrative, and waste services	61.0	70.2	56.1	54.2	55.2	61.9	65.0	93%
Educational services	11.5	12.5	12.7	12.8	13.0	14.5	15.2	100%
Health care and social assistance	126.1	137.9	143.7	147.4	155.0	160.7	165.1	100%
Arts, entertainment, and recreation	11.3	13.5	12.2	12.3	11.9	12.8	14.0	100%
Accommodation and food services	81.5	84.1	72.9	66.3	67.4	71.0	72.7	86%
Other personal services	74.0	73.7	70.2	66.5	67.0	70.6	73.5	99%
Government	252.3	275.9	295.6	292.7	283.4	284.5	288.4	98%
Total	1,818.0	2,000.7	1,728.5	1,586.4	1,611.8	1,658.2	1,686.2	84%

Source: USDC 2014, Bureau of Economic Analysis, Table CA05N.

Table 3.4.15 Personal Income of Residents in Garfield County, 2007-2013 (millions of 2013 dollars)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Personal income	2,364	2,537	2,330	2,174	2,240	2,339	2,359	93%
Earnings	1,722	1,829	1,612	1,470	1,484	1,528	1,539	84%
Dividends, interest, and rent	469	509	476	437	489	543	545	100%
Transfer payments	173	200	242	267	267	268	275	100%
Per capita personal income (dollars)	44,156	45,762	40,814	38,757	39,962	41,110	41,171	90%

Source: USDC 2014, Bureau of Economic Analysis, Table CA05N.

Table 3.4.16 Employment of Workers in Mesa County by Industry, 2007-2013 (annual average jobs)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Agriculture	2,434	2,443	2,419	2,454	(D)	2,402	2,416	98%
Mining	3,478	4,884	3,874	3,752	4,290	4,737	4,009	82%
Utilities	232	241	244	233	221	206	206	84%
Construction	8,896	8,976	7,324	5,796	5,524	5,282	5,441	61%
Manufacturing	3,772	3,866	3,107	2,908	2,979	3,016	3,141	81%
Wholesale trade	2,731	2,831	2,764	2,588	2,558	2,590	2,626	93%
Retail trade	10,859	10,687	10,204	9,836	9,925	9,936	9,993	92%
Transportation and warehousing	3,266	3,470	3,264	3,071	3,263	3,261	3,219	93%
Information	1,161	1,195	1,126	1,095	1,082	1,040	1,025	86%
Finance and insurance	3,830	4,045	4,131	3,874	3,881	3,881	3,980	96%
Real estate and rental and leasing	4,582	4,800	4,343	4,354	4,492	4,445	4,522	94%
Professional, scientific, and tech services	4,420	4,553	4,410	4,257	4,167	4,175	4,184	92%
Management, administrative, and waste services	4,748	5,153	4,813	5,005	4,695	4,827	4,947	96%
Educational services	580	602	680	671	(D)	730	758	100%
Health care and social assistance	9,761	9,989	10,025	9,981	10,071	10,144	10,418	100%
Arts, entertainment, and recreation	1,862	1,870	1,812	1,842	1,823	1,778	1,844	99%
Accommodation and food services	6,566	6,900	6,571	6,267	6,321	6,557	6,800	99%
Other personal services	4,982	5,077	5,009	4,690	4,816	4,872	4,868	96%
Government	9,362	9,701	10,031	10,113	9,977	9,966	9,996	99%
Total	87,522	91,283	86,151	82,787	83,187	83,845	84,393	92%

Source: USDC 2014, Bureau of Economic Analysis, Table CA25N.

Key:
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Table 3.4.17 shows earnings in Mesa County from 2007 through 2013. Since the recession, county-wide earnings have rebounded from their 2010 low to about 90 percent of their 2008 peak. This measure of rebound suggests that Mesa County is more resilient to national economic trends than Garfield County. Throughout the 7-year period, both in down years and high years, government in Mesa County has had the largest payrolls followed by health care. Retail and mining have also maintained relatively strong payrolls. Construction and manufacturing were hit the hardest during the recession, and have been particularly slow to recover.

Table 3.4.18 displays personal income for residents of Mesa County. Like Garfield County, Mesa residents rely upon earnings for most of their personal income. However, earnings accounted for only 59 percent in 2013 compared with 65 percent for Garfield residents. The difference was found almost entirely in transfer payments – a strong indication of the large retirement population in Grand Junction and surrounding communities. Personal income recovered to about 91 percent of its 2008 high.

Tables 3.4.19, 3.4.20, and 3.4.21 show employment, earnings, and personal income information for Rio Blanco County. Unlike Garfield and Mesa counties, Rio Blanco exhibits a strong dependence on government, mining, and construction. Where government employment in Garfield and Mesa counties accounted for 14 and 12 percent, respectively, of all employment in 2013, the public sector in Rio Blanco County accounted for 25 percent. Government has employed approximately 25 percent of all workers in Rio Blanco County since 2009. In this same period, mining (oil, gas, and coal) has been the second largest employer, with nearly 20 percent of all jobs. Construction was the largest employer in 2008, with 22 percent of all jobs, but contracted to just 7 percent in 2012 and 9 percent in 2013. A drop in gas prices starting in 2009 (DOE 2015) and a transition from oil and gas field development to operations (Webb 2010, DNR 2015c) may have been the largest contributors to job reductions in Rio Blanco County, rather than recessionary forces.

The Rio Blanco workforce hit a low in 2012, two years after Garfield and Mesa counties. Industries with the largest reductions from a 2007 high were construction, manufacturing, health care, and professional services. Overall, one out of every six jobs in Rio Blanco County during 2007 was eliminated by 2013.

Table 3.4.20 shows earnings in Rio Blanco County from 2007 through 2013. The pattern for earnings is similar to employment, but more extreme. Mining and government had the largest and relatively stable payrolls from 2008 through 2013, but many other industries contracted significantly. Payrolls in seven industries in 2013 were less than 70 percent of their 2007 peak. Of those, construction, manufacturing, real estate, and transportation in 2013 were less than half of their 2007 peak. County-wide, earnings in 2013 were 70 percent of those in 2007.

Table 3.4.21 displays personal income for residents of Rio Blanco County. Earnings accounted for 68 percent of personal income in 2013, which was the highest share among the three counties. In 2007, earnings accounted for a very high 78 percent of all personal income. In 2013, dividends, interest, and rent provided 18 percent of personal income, while transfer payments accounted for the final 14 percent. Most notable about Rio Blanco is that per capita income in 2013 was the highest among all three counties at $42,931—15 percent higher than Mesa county and four percent higher than Garfield. The dominance of the mining industry in Rio Blanco County, and which paid an annual average compensation of $82,000 per job in 2013, was the likely basis for this high level of income per capita.

Table 3.4.17 Earnings of Workers in Mesa County by Industry, 2007-2013 (millions of 2013 dollars)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Agriculture	18.8	16.1	15.3	13.9	(D)	16.8	20.4	100%
Mining	284.7	408.3	281.0	267.9	352.1	380.8	322.0	79%
Utilities	22.3	23.0	24.0	24.0	23.1	19.9	20.5	85%
Construction	413.9	456.0	373.7	275.6	261.9	257.4	270.9	59%
Manufacturing	181.2	182.8	148.7	142.6	144.8	149.5	154.8	85%
Wholesale trade	156.9	171.7	163.0	145.1	148.1	152.9	157.7	92%
Retail trade	323.2	322.6	293.4	280.7	277.2	281.0	283.6	88%
Transportation and warehousing	176.0	209.0	195.9	188.3	210.8	229.7	221.6	96%
Information	59.5	61.4	59.8	56.9	55.0	54.8	51.8	84%
Finance and insurance	152.0	149.6	158.3	143.4	135.2	142.9	150.3	95%
Real estate and rental and leasing	64.6	60.7	48.3	47.9	46.4	53.9	53.9	83%
Professional, scientific, and tech services	171.2	197.4	189.1	177.2	182.2	185.2	185.2	94%
Management, administrative, and waste services	132.3	168.2	158.3	153.2	152.9	159.2	154.0	92%
Educational services	11.2	9.9	11.3	11.6	(D)	12.6	12.9	100%
Health care and social assistance	483.6	507.9	528.0	530.3	526.2	526.7	546.4	100%
Arts, entertainment, and recreation	22.9	22.4	21.7	20.7	19.5	19.7	20.2	88%
Accommodation and food services	141.8	149.6	136.8	132.0	134.1	143.0	145.6	97%
Other personal services	168.6	166.6	167.0	162.2	158.3	162.8	162.7	97%
Government	566.3	612.1	638.7	625.4	599.2	591.7	589.3	92%
Total	3,550.9	3,895.5	3,612.5	3,399.0	3,453.7	3,540.3	3,524.0	90%

Source: USDC 2014, Bureau of Economic Analysis, Table CA05N.

Key:
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Table 3.4.18 Personal Income of Residents in Mesa County, 2007-2013 (millions of 2013 dollars)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Personal income	5,476	5,841	5,488	5,241	5,351	5,515	5,492	94%
Earnings	3,368	3,615	3,361	3,148	3,198	3,271	3,223	89%
Dividends, interest, and rent	1,233	1,318	1,138	1,043	1,117	1,212	1,222	93%
Transfer payments	875	908	989	1,050	1,036	1,032	1,048	100%
Per capita personal income (dollars)	39,272	40,801	37,118	35,784	36,277	37,318	37,222	91%

Source: USDC 2014, Bureau of Economic Analysis, Table CA05N.

Key:
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Table 3.4.19 Employment of Workers in Rio Blanco County by Industry, 2007-2013 (annual average jobs)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Agriculture	(D)	(D)	(D)	(D)	(D)	(D)	(D)	--
Mining	947	1,089	917	939	893	918	867	80%
Utilities	(D)	(D)	(D)	(D)	(D)	51	(D)	-
Construction	1,291	898	475	340	406	319	418	32%
Manufacturing	100	83	90	82	71	44	46	46%
Wholesale trade	(D)	(D)	(D)	(D)	(D)	49	(D)	--
Retail trade	340	326	342	304	305	295	295	86%
Transportation and warehousing	191	161	134	149	143	137	143	75%
Information	26	30	32	33	34	35	38	100%
Finance and insurance	75	91	104	138	116	111	111	80%
Real estate and rental and leasing	120	158	121	124	154	143	151	96%
Professional, scientific, and tech services	168	151	129	(D)	(D)	(D)	115	68%
Management, administrative, and waste services	131	173	197	213	199	213	227	100%
Educational services	26	18	16	27	21	20	20	74%
Health care and social assistance	126	109	89	84	66	74	82	65%
Arts, entertainment, and recreation	70	65	63	65	66	60	70	100%
Accommodation and food services	398	403	364	312	286	283	287	71%
Other personal services	188	178	180	173	169	164	162	86%
Government	1,074	1,186	1,154	1,172	1,157	1,208	1,215	100%
Total	5,746	5,605	4,899	4,788	4,736	4,666	4,776	83%

Source: USDC 2014, Bureau of Economic Analysis, Table CA25N.

Key:
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Table 3.4.20 Earnings of Workers in Rio Blanco County by Industry, 2007-2013 (millions of 2013 dollars)

Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Agriculture	(D)	(D)	(D)	(D)	(D)	(D)	(D)	
Mining	82.6	99.7	82.5	81.4	81.9	77.5	71.2	71%
Utilities	(D)	(D)	(D)	(D)	(D)	6.0	(D)	
Construction	118.7	89.5	41.6	25.7	35.0	25.3	33.9	29%
Manufacturing	3.4	3.2	5.0	2.4	2.2	1.2	1.4	27%
Wholesale trade	(D)	(D)	(D)	(D)	(D)	1.6	(D)	
Retail trade	22.2	17.2	17.5	13.7	11.5	11.0	11.4	52%
Transportation and warehousing	14.2	10.1	7.9	9.0	9.0	7.5	6.7	47%
Information	1.3	1.1	1.2	0.9	0.7	0.7	0.9	68%
Finance and insurance	2.0	2.0	2.3	2.9	2.7	2.4	2.5	87%
Real estate and rental and leasing	2.4	2.7	1.2	0.6	0.6	0.6	1.0	36%
Professional, scientific, and tech services	5.1	4.5	3.7	(D)	(D)	(D)	2.8	55%
Management, administrative, and waste services	4.0	5.5	5.8	5.9	7.8	8.7	10.2	100%
Educational services	0.1	0.1	(L)	(L)	0.1	0.1	0.1	100%
Health care and social assistance	3.1	2.7	2.1	2.1	1.8	2.0	2.4	76%
Arts, entertainment, and recreation	0.4	0.4	0.7	0.8	0.9	0.9	1.4	100%
Accommodation and food services	9.7	12.6	11.5	10.3	7.9	7.3	7.1	57%
Other personal services	17.3	15.7	17.0	16.4	14.2	12.7	12.8	74%
Government	50.5	55.1	58.7	59.9	58.0	61.2	61.5	100%
Total	352.1	332.3	270.5	246.9	256.8	240.8	248.3	71%

Source: USDC 2014, Bureau of Economic Analysis, Table CA05N.

Key:
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Table 3.4.21 Personal Income of Residents in Rio Blanco County, 2007-2013 (millions of 2013 dollars)

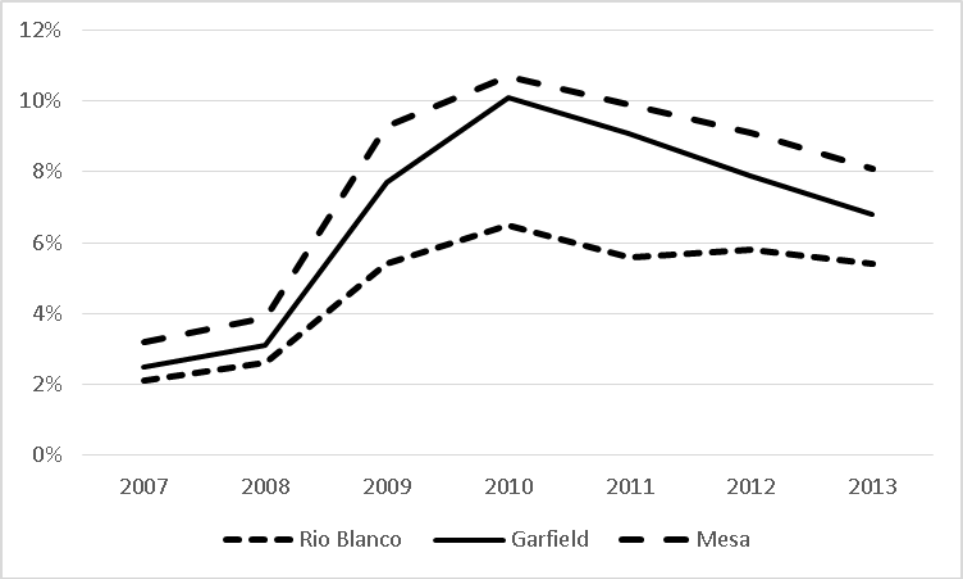
Description	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2013 as a Percent of Highest Year*
Personal income	326	320	296	283	293	289	292	90%
Earnings	247	237	214	200	206	197	199	81%
Dividends, interest, and rent	45	50	44	41	45	53	53	100%
Transfer payments	34	33	38	41	42	40	40	96%
Per capita personal income (dollars)	51,156	49,009	43,700	42,572	42,965	42,518	42,931	84%

Source: USDC 2014, Bureau of Economic Analysis, Table CA05N.

3.4.3.6 Labor Force and Unemployment

The labor force in any geographic area is composed of persons who are classified as either employed or unemployed. According to the U.S. Bureau of Labor Statistics (USDL 2015a), employment includes all persons 16 years and older in the civilian non-institutional population who work as paid employees or proprietors. Unemployment includes all persons 16 years and older who are without paid employment, but available for work and actively seeking employment. The unemployment rate is determined by dividing all persons who are unemployed by the labor force.

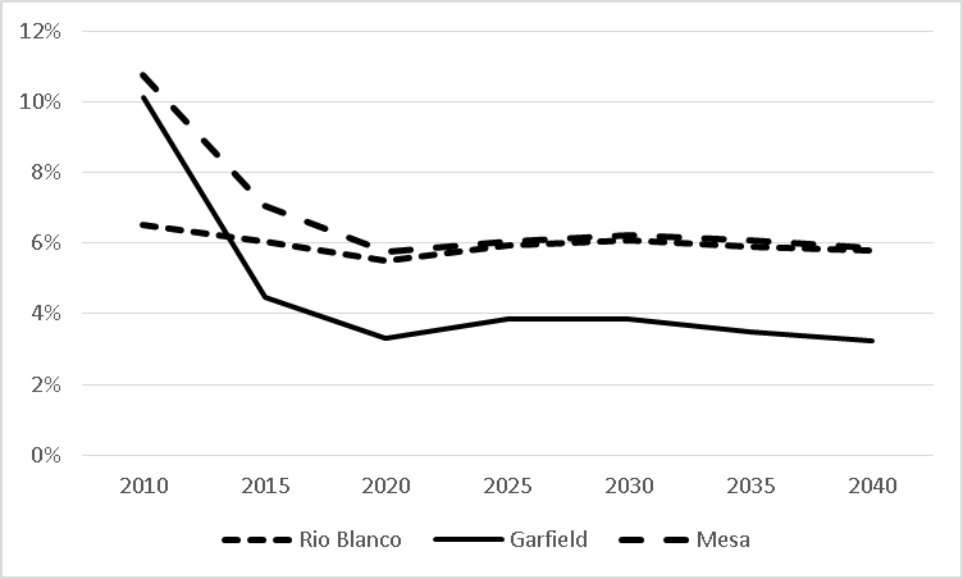
Figure 3.4-11 shows the unemployment rate for each county from 2007 through 2013 (CDLE 2015). The national unemployment rate over the same time period ranged from 4.6 percent in 2007 to a high of 9.6 percent in 2010, then dropping to 7.4 percent in 2013. Thus, unemployment in Mesa County was slightly higher than the national average during and after the recession, about the same as the national average in Garfield County, and substantially lower in Rio Blanco County. The unemployment rate in all counties was well below the national average in 2007. Typically, unemployment rates are low in rural areas simply because persons can more easily assess employment potential in the area and then leave in search of better opportunities elsewhere. Resort destination areas, such as Glenwood Springs, often have higher unemployment rates as persons choose to remain longer in attractive environs, even when unemployed.



Source: CDLE 2015.

Figure 3.4-11 Unemployment Rate by County, 2007-2013 (percent)

The Colorado State Demography Office (SDO) (DOLA 2014b) has forecast that unemployment in Mesa and Rio Blanco counties will drop to about 6 percent by 2020 and continue in that range out to 2040 (Figure 3.4-12). The forecast for Garfield County shows unemployment dropping to less than 4 percent during the same time period.



Source: DOLA 2014b.

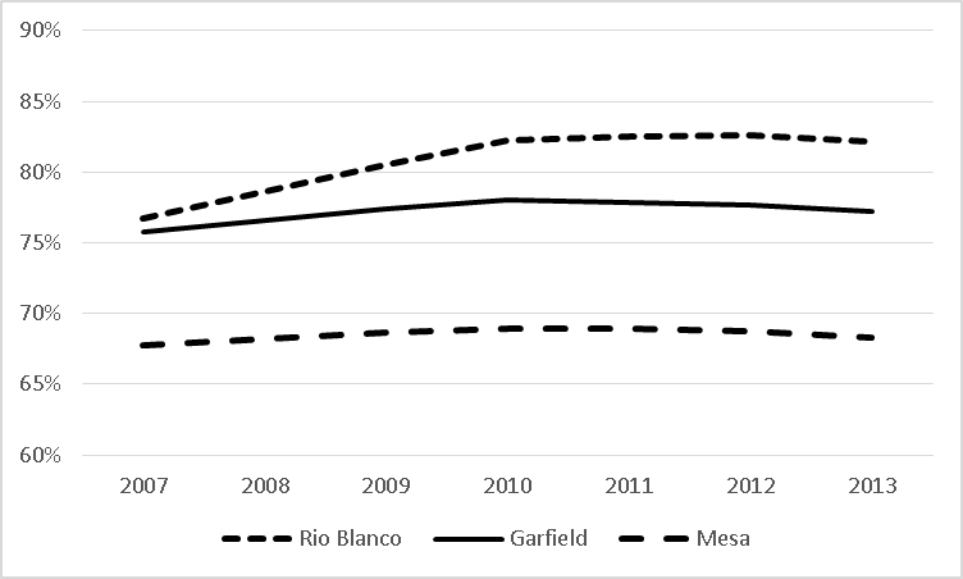
Figure 3.4-12 Forecast Unemployment Rate by County, 2010-2040 (percent)

As the nation continues to recover from the recession, the labor participation rate has garnered more attention. The labor participation rate is defined as the number of persons in the labor force divided by total persons in the civilian non-institutional population (USDL 2015a). From 1989 to 2008, the national rate was relatively stable, hovering between 66 percent and 67 percent (USDL 2015b). In early 2009, the rate started dropping and reached just 63 percent in 2013. Economists expressed concern that many individuals were prematurely leaving the labor force because of discouragement from unsuccessful attempts to obtain employment. Figure 3.4-13 shows the participation rate for each county between 2007 and 2013 (DOLA 2014b). All counties demonstrate a healthy participation rate that meets or exceeds the national average. The rates in Garfield and Rio Blanco counties were above 75 percent.

Figure 3.4-14 shows the SDO forecast of the labor participation rate for all three counties out to 2040 (DOLA 2014b). Mesa County is nearest to the historic national average, while Garfield County ranges above 70 percent, and Rio Blanco County is above 80 percent. These forecasts and the unemployment forecasts in Figure 3.4-12 suggest that the area can expect a healthy mix of job opportunities and workers in the coming years.

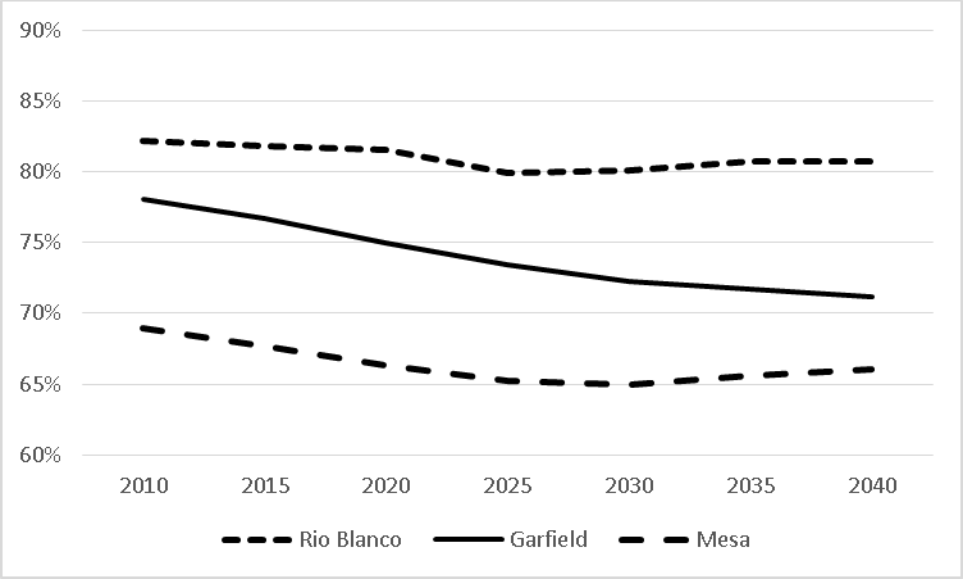
3.4.3.7 Economic Models and the Contribution of BLM Management

To estimate the contributions and effects of BLM management in the Planning Area, the BLM developed a unique economic model of each county. Creating individual county models offers two advantages over a single model that includes all counties: (1) effects can be located by county; and (2) larger counties (e.g., Mesa) do not mask conditions or effects in smaller counties (e.g., Rio Blanco). The BLM linked all three models so that effects originating in one county trigger secondary effects in the other two.



Source: DOLA 2014b.

Figure 3.4-13 Labor Force Participation Rate by County, 2007-2013 (percent)



Source: DOLA 2014b.

Figure 3.4-14 Forecast Labor Participation Rate by County, 2010-2040 (percent)

All models built and run for the analyses utilized the IMPLAN® modeling system (IMPLAN 2014), which includes proprietary data sets. IMPLAN® data provided a foundation for each model, but all models were customized using employment estimates provided by the Colorado Department of Local Affairs SDO (DOLA 2014c). SDO estimates are prepared with knowledge of each Colorado county and in concert with local government officials who periodically review the estimates. Because SDO methodologies differ from the U.S. Bureau of Economic Analysis (BEA), their employment estimates sometimes diverge from Federal estimates. For this reason, county employment and earnings presented in this subsection differ from the time series data presented earlier in Section 3.4.3.5. In addition to SDO data, the BLM used publicly disclosed employment data for individual mines in Colorado provided by the Colorado Department of Natural Resources, Division of Reclamation, Mining, and Safety (DNR 2014c). To customize production by the oil and gas extraction industry, the BLM obtained data from county assessor offices (Garfield County Assessor's Office 2014, Mesa County Assessor's Office 2014, Rio Blanco County Assessor's Office 2014), the Colorado Department of Local Affairs, Division of Property Taxation (DOLA 2014a), and the Colorado Oil and Gas Conservation Commission (DNR 2015b).

Table 3.4.22 presents modeled employment by industry for each county, the three-county region, and Colorado. This presentation breaks out the mining and services industries that permit a more in-depth look at both the energy-based and recreation-based elements of the area economy. Energy-based sectors include oil and gas extraction, drilling and support services, and professional and technical services. Drilling and support services, which are key for development activities, are primarily clustered in Mesa and Garfield counties. Nearly 60 percent of 2013 sector employment in the area was located in Mesa County, with another 32 percent located in Garfield County. The three-county region provided nearly one-third of all drilling and support service jobs in Colorado. Extraction-based employment was primarily located in Garfield County, with almost 60 percent of area totals, followed by Mesa County with one-fourth and Rio Blanco with one-sixth. Area employment in the oil and gas extraction sector accounted for 9 percent of statewide employment and, therefore, was not as dominant statewide as the drilling and support services sector. Professional and technical services, another important support service to the oil and gas industry, is primarily located in Mesa County, with 64 percent of area totals, followed by 34 percent in Garfield County. While this sector is sizeable in the three-county region, it accounted for just 2 percent of sector employment statewide in 2013.

Recreation-related sectors include arts, entertainment, and recreation services, as well as lodging and food services. While recreation participants spend money in many retail and service sectors, the BLM uses these two sectors in this analysis as an indicator of the visitor services or recreation industry. These two sectors are especially aligned with both visitors from out of the area (e.g., accommodations) as well as local residents who engage in recreation (e.g., recreation services, food services). Two-thirds of area jobs in each sector were located in Mesa County in 2013, followed by roughly one-third in Garfield County. Recreation is an important seasonal component to the Rio Blanco County economy, but the number of jobs in these sectors has been small when compared to the other two counties. Table 3.4.23 shows modeled earnings by industry for each county, the three-county region, and Colorado. Patterns and shares of earnings are similar to those for employment described above.

Table 3.4.22 Modeled Employment by Industry, County, and State, 2013 (annual average jobs)

Description	Garfield County		Mesa County		Rio Blanco County		Three-County Region Total		Colorado
	Jobs	% of Area	Jobs	% of Area	Jobs	% of Area	Jobs	% of State	Jobs
Agriculture	752	22%	2,335	67%	377	11%	3,464	8%	45,008
Mining									
Oil & gas extraction	718	59%	299	25%	205	17%	1,218	9%	13,006
Other mining	45	18%	40	16%	164	66%	252	5%	5,440
Drilling & support services	1,462	32%	2,692	59%	394	9%	4,549	29%	15,623
Construction	3,962	43%	4,956	53%	402	4%	9,320	5%	182,061
Manufacturing	367	11%	2,868	88%	25	1%	3,260	2%	137,041
Wholesale & retail trade	4,179	26%	11,461	72%	281	2%	15,921	4%	389,512
Transportation, information, & utilities	1,296	23%	4,074	74%	152	3%	5,523	3%	162,834
Finance, insurance, real estate, & rental	2,204	30%	5,087	68%	137	2%	7,427	3%	225,277
Business services									
Professional & technical	2,036	34%	3,829	64%	100	2%	5,965	2%	271,275
Management, administrative, & waste	1,423	24%	4,191	72%	202	3%	5,816	3%	219,580
Personal services									
Education, health, & other	5,099	25%	15,381	74%	239	1%	20,720	4%	521,928
Arts, entertainment, and recreation	759	34%	1,439	64%	58	3%	2,255	3%	72,552
Lodging and food services	2,810	29%	6,512	68%	235	2%	9,558	4%	248,129
Government	5,570	33%	9,971	60%	1,213	7%	16,755	4%	466,198
Total	32,682	29%	75,136	67%	4,184	4%	112,003	4%	2,975,462

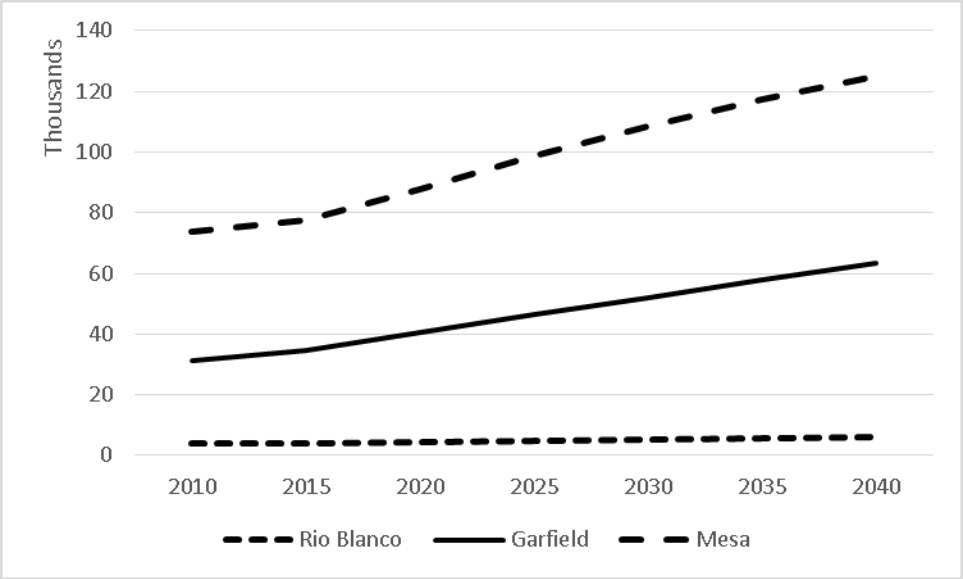
Sources: DOLA 2014c; DNR 2015a; IMPLAN 2014.

Table 3.4.23 Modeled Earnings by Industry, County, and State, 2013 (millions of dollars)

Description	Garfield County		Mesa County		Rio Blanco County		Three-County Region Total		Colorado
	$ Million	% of Area	$ Million	% of Area	$ Million	% of Area	$ Million	% of State	$ Million
Agriculture	19.6	20%	68.7	71%	8.3	9%	96.6	7%	1,403
Mining									
Oil & gas extraction	62.0	63%	19.2	20%	16.9	17%	98.1	7%	1,361
Other mining	2.2	13%	1.7	10%	12.9	77%	16.8	3%	518
Drilling & support services	113.4	32%	218.7	61%	27.0	8%	359.1	26%	1,385
Construction	195.0	42%	236.9	51%	29.8	6%	461.6	4%	10,471
Manufacturing	24.9	14%	157.4	86%	0.9	0%	183.2	2%	10,812
Wholesale & retail trade	183.1	29%	440.1	69%	12.3	2%	635.4	3%	18,900
Transportation, information, & utilities	86.3	23%	276.0	74%	12.9	3%	375.3	2%	15,749
Finance, insurance, real estate, & rental	108.5	32%	228.2	67%	3.5	1%	340.2	3%	12,413
Business services									
Professional & technical	68.7	31%	147.4	67%	2.7	1%	218.7	1%	21,088
Management, administrative, & waste	72.8	34%	129.2	61%	11.2	5%	213.2	2%	12,736
Personal services									
Education, health, & other	250.3	26%	693.2	73%	7.9	1%	951.4	4%	25,634
Arts, entertainment, and recreation	12.9	35%	23.1	63%	0.9	3%	36.9	2%	1,973
Lodging and food services	67.8	32%	136.7	65%	6.2	3%	210.7	3%	6,282
Government	340.8	31%	666.3	61%	77.2	7%	1,084.3	3%	33,873
Total	1,608.1	30%	3,443.0	65%	230.6	4%	5,281.7	3%	174,599

Sources: DOLA 2014c; DNR 2015a; IMPLAN 2014.

Figure 3.4-15 shows the SDO forecast of total employment for all three counties out to 2040 (DOLA 2014b). Over the 25-year period between 2015 and 2040, SDO projects Mesa County employment to grow at a rate of 1.9 percent, Garfield County at a slightly higher rate of 2.4 percent, and Rio Blanco at a slightly lower rate of 1.5 percent. Compared with a statewide forecast growth rate of 1.4 percent, these forecasts suggest that the area can expect a healthy job market over the coming decades.



Source: DOLA 2014b.

Figure 3.4-15 Forecast Employment by County, 2010-2040 (average annual jobs)

The BLM's management of public lands triggers economic effects in three ways: output production from resource management programs, Federal and tax payments to local governments, and agency expenditures. Recreation effects are based on expenditures by locals and non-locals associated with their enjoyment of outdoor recreation of all types (including wildlife and fish-based) on BLM-managed lands. Grazing outputs are based on livestock sales attributable to forage consumed on BLM-managed lands. Minerals effects include development and operation expenditures by private firms necessary to extract and sell Federal estate oil and gas, plus the effect of local jurisdictions that spend revenues generated by Federal estate oil and gas production. Revenues include: (1) Federal payments distributed to local jurisdictions by the Colorado Department of Local Affairs, Division of Local Government (DLG) (DOLA 2013); (2) Colorado severance tax also distributed to local jurisdictions by DLG; and (3) local property tax collections. Agency expenditures include all BLM operational expenses to accomplish activities such as watershed restoration, mineral lease monitoring, and transportation management in the Planning Area.

The BLM estimated economic contributions from resource outputs based on the availability of both BLM records and either production or spending data. BLM records and research data are readily available for forage, minerals, and recreation use of public lands. Records of BLM agency expenditures and of payments to local governments provided a sound basis for estimating the local contributions triggered by Federal and local government spending.

Analysis results for employment and earnings include the sum of all direct effects triggered by spending or production, plus supply chain (indirect) effects in supporting industries and other (induced) effects from industry employees spending payrolls.

Tables 3.4.24 through 3.4.27 display the 2013 economic contribution of BLM management in the Planning Area. The BLM contributed over 9,000 jobs and $47 million of earnings to the three-county region. These were approximately 1 percent of all area jobs and earnings. Tables 3.4.24 and 3.4.25 show these economic contributions by program area and county. Minerals activities accounted for the greatest number of jobs and earnings, with over 590 jobs and nearly $36 million of earnings area-wide. Over 50 percent of the jobs and earnings were based in Garfield County, followed by about 40 percent in Mesa County, and less than 5 percent in Rio Blanco County. Recreation was the next largest program, with nearly 350 jobs and $10 million of earnings. Over 90 percent of the jobs and earnings were based in Garfield County, and the balance in Rio Blanco. In Garfield County, recreation-based jobs were about 90 percent of those generated by mineral activity. Grazing and agency expenditures accounted for about 26 jobs and $800,000 in earnings in the three-county region.

Tables 3.4.26 and 3.4.27 portray BLM economic contributions by industry and county. Because of supply-chain (indirect) and employee spending (induced) effects, every industry in every county receives a portion of BLM contributions. For some industries, the job and earnings contributions are very small, as indicated by values preceded by "<". Over half of all employment generated by Planning Area management is found in: (1) lodging and food services; (2) drilling and support services; (3) wholesale and retail trade; and (4) education, health, and other personal services. Over half of all earnings generated by Planning Area management are found in: (1) drilling and support services; (2) oil and gas extraction; (3) transportation, information, and utilities; and (4) lodging and food services. Except for lodging and food services, these industries have relative high compensation rates, which account for the high share of earnings.

3.4.3.8 Public Finance

This section describes trends in public revenues and expenditures since 2007 in Garfield, Mesa, and Rio Blanco counties. The emphasis is on Garfield County because it is nearest to the Planning Area and potentially the most affected by resource management planning for the Planning Area. This section presents information on county-level government and for municipal governments selected for their proximity to the Planning Area.

Property Tax Trend

Oil and gas development has changed the property tax base in the three-county region over the past decade. The change stands out in the two smaller counties, Garfield County and Rio Blanco County, with most of the change occurring from 2002 to 2007. Table 3.4.28 illustrates the change using selected data from 2002, 2007, and 2013.

Oil and gas property increased to 65 percent of Garfield County's total assessed value in 2007, up from 28 percent in 2002. In 2013, oil and gas property was 70 percent of Garfield County's total assessed value. In Rio Blanco County, oil and gas property began as a large share of total assessed value, at 61 percent in 2002, increased to 76 percent in 2007, and then declined back to 57 percent in 2013 in response to exploration and production trends favoring other regions. Oil and gas property's share of total assessed value in Mesa County, though relatively small, also increased during the same period, from 2 percent in 2002, to 5 percent in 2007, and to 9 percent in 2013.

Table 3.4.24 Employment Contributed by BLM Management of the Planning Area by Program by County, 2013 (annual average jobs)

Description	Garfield County		Mesa County		Rio Blanco County		Three-County Region Total
	Jobs	% of Area	Jobs	% of Area	Jobs	% of Area	Jobs
Recreation	314	91%	-	-	31	9%	345
Grazing	18	99%	-	-	<1	1%	18
Minerals (including taxes & Federal payments to counties)	348	53%	279	43%	26	4%	653
Agency Expenditures	8	100%	-	-	-	-	8
Total	688	67%	279	27%	57	6%	1,024

Table 3.4.25 Earnings Contributed by BLM Management of the Planning Area by Program by County, 2013 (millions of dollars)

Description	Garfield County		Mesa County		Rio Blanco County		Three-County Region Total
	$ Million	% of Area	$ Million	% of Area	$ Million	% of Area	$ Million
Recreation	9.3	92%	-	-	0.9	8%	10.2
Grazing	0.3	99%	-	-	<0.1	1%	0.3
Minerals (including taxes & Federal payments to counties)	21.9	55%	16.9	43%	0.8	2%	39.6
Agency Expenditures	0.5	100%	-	-	-	-	0.5
Total	32.0	63%	16.9	34%	1.6	3%	50.6

Table 3.4.26 Employment Contributed by BLM Management of the Planning Area by Industry and County, 2013 (annual average jobs)

Description	Garfield County		Mesa County		Rio Blanco County		Three-County Region Total
	Jobs	% of Area	Jobs	% of Area	Jobs	% of Area	Jobs
Agriculture	15	93%	1	4%	1	3%	17
Mining							
Oil & gas extraction	54	96%	2	4%	<1	<1%	56
Other mining	1	71%	<1	22%	<1	7%	1
Drilling & support services	49	42%	66	58%	<1	<1%	115
Construction	40	79%	11	21%	<1	1%	51
Manufacturing	2	61%	1	39%	<1	<1%	4
Wholesale & retail trade	71	70%	25	25%	5	5%	101
Transportation, information, & utilities	16	22%	56	77%	1	1%	73
Finance, insurance, real estate, rental, & leasing	24	59%	16	39%	1	2%	41
Business services							
Professional & technical	57	72%	21	26%	1	2%	80
Management, administrative, & waste	21	53%	17	44%	1	3%	39
Personal services							
Education, health, & other	49	58%	33	40%	2	2%	84
Arts, entertainment, and recreation	45	85%	3	6%	5	9%	52
Lodging and food services	198	85%	15	6%	21	9%	234
Government	46	61%	10	13%	20	26%	77
Total	688	67%	279	27%	57	6%	1,024

Table 3.4.27 Earnings Contributed by BLM Management of the Planning Area by Industry and County, 2013 (millions of dollars)

Description	*Garfield County*		*Mesa County*		*Rio Blanco County*		*Three-County Region Total*
	$ Million	*% of Area*	*$ Million*	*% of Area*	*$ Million*	*% of Area*	*$ Million*
Agriculture	0.2	81%	< 0.1	16%	< 0.1	3%	0.2
Mining							
Oil & gas extraction	6.7	98%	0.2	2%	< 0.1	<1%	6.9
Other mining	0.1	78%	< 0.1	13%	< 0.1	9%	0.1
Drilling & support services	3.6	41%	5.1	59%	< 0.1	<1%	8.6
Construction	1.9	79%	0.5	21%	< 0.1	1%	2.4
Manufacturing	0.1	42%	0.1	58%	< 0.1	<1%	0.2
Wholesale & retail trade	2.8	71%	1.0	25%	0.2	4%	4.0
Transportation, information, & utilities	1.0	17%	5.0	82%	< 0.1	1%	6.1
Finance, insurance, real estate, rental, & leasing	1.1	54%	1.0	46%	< 0.1	1%	2.1
Business services							
Professional & technical	2.0	69%	0.9	30%	< 0.1	1%	2.9
Management, administrative, & waste	0.9	64%	0.5	33%	< 0.1	2%	1.5
Personal services							
Education, health, & other	2.4	60%	1.5	39%	< 0.1	1%	4.0
Arts, entertainment, and recreation	1.0	87%	< 0.1	4%	0.1	8%	1.1
Lodging and food services	5.0	86%	0.3	5%	0.5	9%	5.8
Government	3.3	68%	0.8	17%	0.7	15%	4.9
Total	32.0	63%	16.9	34%	1.6	3%	50.6

Table 3.4.28 Distribution of Assessed Value and Oil and Gas Property Value in the Three-County Region, 2002, 2007, and 2013

Millions of Nominal Dollars		*Garfield County*	*Mesa County*	*Rio Blanco County*
2002	Total Assessed Value	$918.3	$955.7	$339.6
	Assessed Value from Oil and Gas Property	$257.6	$14.6	$208.6
	Oil and Gas Property Value as Share of Total Assessed Value	28%	2%	61%
2007	Total Assessed Value	$2,857.9	$1,782.1	$720.8
	Assessed Value from Oil and Gas Property	$1,867.1	$96.3	$548.3
	Oil and Gas Property Value as Share of Total Assessed Value	65%	5%	76%
2013	Total Assessed Value	$2,896.9	$1,827.0	$1,295.8
	Assessed Value from Oil and Gas Property	$2,033.4	$165.5	$732.3
	Oil and Gas Property Value as Share of Total Assessed Value	70%	9%	57%

Sources: State of Colorado 2003b, 2008b, 2014.

Note:
Percentages calculated by Lloyd Levy Consulting, LLC.

Revenue Trends for Counties

Garfield County depends considerably more than Mesa and Rio Blanco counties on property taxes for total revenue. Since 2007, property taxes have averaged about 51 percent of total revenue in Garfield County, 22 percent in Mesa County, and 24 percent in Rio Blanco County (State of Colorado 2015c).

Intergovernmental transfers (mainly the reimbursement for human services from the Colorado and Federal governments) and local sales-and-use taxes are also large parts of the revenue structure in these counties. Intergovernmental transfers have averaged about 23 percent of total revenue for Garfield County government, 39 percent for Mesa County, and 29 percent for Rio Blanco County for the same period. Sales-and-use taxes have averaged 7 percent of total revenue for Garfield County, 24 percent for Mesa County, and 19 percent for Rio Blanco County (State of Colorado 2015c).

Payments to counties from higher levels of government typically are the largest part of these counties' intergovernmental revenues. However, during the periods of high oil and gas activity, counties that host the activity receive oil- and gas-related intergovernmental revenue as statutory distributions of State-collected severance taxes and State receipts of Federal mineral lease royalties and as grants from the State impact assistance fund (State of Colorado 2015c).

Sales and Use Tax Trend

The total sales and use tax collected by the State by county (including all taxes collected by all jurisdictions) is an index of how variable this particular tax is as a source of local revenue. As a rule, municipal government relies more on the sales tax for general revenue than do other types of local government in Colorado.

Table 3.4.29 tracks this index in the three-county area from 2005 to the present. This shows that, over time, the revenue capacity of local government, and mainly of municipalities, depends on economic conditions. The pattern seen in Table 3.4.29 suggests that growth in the oil and gas industry generally is a result of influences in outside energy markets and the general economy.

Table 3.4.29 State Sales Tax Collected at 2.9 Percent in All Jurisdictions within Garfield, Mesa, and Rio Blanco Counties, 2002 to 2013

Millions $	*Garfield County*	*Mesa County*	*Rio Blanco County*
2002	$ 18.9	$ 45.9	$ 1.3
2003	$ 20.0	$ 48.1	$ 1.5
2004	$ 22.2	$ 50.9	$ 1.7
2005	$ 25.8	$ 57.4	$ 2.1
2006	$ 31.1	$ 65.4	$ 2.5
2007	$ 36.7	$ 75.6	$ 3.4
2008	$ 38.7	$ 78.1	$ 4.3
2009	$ 28.3	$ 59.4	$ 4.2
2010	$ 29.4	$ 60.8	$ 6.2
2011	$ 34.5	$ 65.2	$ 7.0
2012	$ 33.2	$ 65.5	$ 5.1
2013	$ 34.1	$ 66.4	$ 3.1

Sources: State of Colorado 2002, 2003a, 2004, 2005, 2006a, 2007a, 2008a, 2009a, 2010a, 2011a, 2012a, 2013a.

Sales and use tax receipts dominate the budgets of potentially affected municipalities in proximity to the Planning Area. Municipalities may also tax property, but cities and towns in proximity to the Planning Area have limited property tax capacity. This makes the revenue generating capacity of municipal governments particularly sensitive to economic trends in the oil and gas industry and the general economy.

Table 3.4.30 presents the sales tax as a percent of total revenue for selected cities and towns in Garfield County selected for proximity to the Planning Area. The table also presents the data for Garfield County as a point of comparison for reliance on the sales tax as a local government revenue source. In the towns of Parachute and Silt, lower sales tax as a percentage of revenue suggests a disproportionate fall because of lower sales and a loss of retail as workers in the area temporarily out-migrate after the drilling boom.

Table 3.4.30 Local Government Reliance on the Sales Tax for Selected Place in Garfield County, 2005 through 2012

% Sales Tax Rev	*2005*	*2007*	*2009*	*2011*	*2012*
Garfield County	14%	9%	5%	9%	9%
Glenwood Springs	56%	57%	51%	36%	50%
New Castle	19%	15%	11%	35%	39%
Parachute	39%	58%	31%	29%	NA

Table 3.4.30 Local Government Reliance on the Sales Tax for Selected Place in Garfield County, 2005 through 2012

% Sales Tax Rev	*2005*	*2007*	*2009*	*2011*	*2012*
Rifle	49%	56%	47%	51%	54%
Silt	30%	30%	20%	22%	NA

Source: Percentages calculated by Lloyd Levy Consulting from State of Colorado 2015c.

Key:
NA = State of Colorado 2015c provides budget or audited financial information restated to be comparable across local governments and over time. However, State of Colorado 2015c does not have data for every local government for every year.

Trend in Direct Distribution of Severance Tax and Federal Mineral Lease Receipts

The Colorado system of State severance tax and Federal mineral lease revenue sharing transfers money to local governments, where it shows up as intergovernmental revenue. The primary transfers occur through direct distributions, which are shares distributed to local government according to State-legislated formulas. Table 3.4.31 summarizes the direct distributions since 2009. The payments since 2009 reflect a peak, a dip, and a rebound in 2014 of receipts from oil and gas severance taxes and Federal royalties.

Table 3.4.31 Payments to Local Governments and School Districts in the Three-County Region Under the Colorado Federal Mineral Lease and State Severance Tax Direct Distribution Program, 2009 to 2014

In Millions of Nominal$	*Severance Tax to Counties and Municipalities*	*Federal Mineral Lease Receipts to Counties/ Federal Mineral Lease Act Districts and Municipalities*	*Federal Mineral Lease Receipts to School Districts*
Garfield County (all entities)			
2009	$7.3	$11.3	$0.9
2010	$1.8	$4.3	$0.4
2011	$3.5	$6.0	$0.5
2012	$3.7	$6.5	$0.6
2013	$3.0	$3.8	$0.3
2014	$4.3	$9.1	$0.8
Cumulative	$23.6	$41.0	$3.5
Mesa County (all entities)			
2009	$7.6	$3.7	$0.3
2010	$1.5	$2.1	$0.2
2011	$2.7	$2.6	$0.2
2012	$3.0	$3.1	$0.3
2013	$1.9	$1.7	$0.1
2014	$2.7	$2.5	$0.2
Cumulative	$19.4	$15.7	$1.3

Table 3.4.31 Payments to Local Governments and School Districts in the Three-County Region Under the Colorado Federal Mineral Lease and State Severance Tax Direct Distribution Program, 2009 to 2014

In Millions of Nominal$	*Severance Tax to Counties and Municipalities*	*Federal Mineral Lease Receipts to Counties/ Federal Mineral Lease Act Districts and Municipalities*	*Federal Mineral Lease Receipts to School Districts*
Rio Blanco County (all entities)			
2009	$2.5	$3.7	$0.3
2010	$0.7	$4.1	$0.3
2011	$1.6	$5.6	$0.5
2012	$1.3	$6.5	$0.6
2013	$0.9	$4.2	$0.4
2014	$1.7	$5.3	$0.4
Cumulative	$8.7	$29.4	$2.5

Source: State of Colorado 2015d.

Since 2009, the State formula for direct distribution follows the tally of local residents employed in mineral extraction, mining and well permits, mineral production, population, and road miles. Table 3.4.32 presents the share of cumulative direct distributions received by local government in Garfield County since 2009.

Table 3.4.32 Share of Cumulative Direct Distributions Received by Local Government in Garfield County Since 2009

Shares of Cumulative Distributions Since 2009	*Severance Tax to Counties and Municipalities*	*Federal Mineral Lease Receipts to Counties/ Federal Mineral Lease Act Districts and Municipalities*
Carbondale, Town of	5%	5%
Garfield County	60%	24%
Garfield County FMLA District [a]	NA	37%
Glenwood Springs, City of	7%	7%
New Castle, Town of	4%	4%
Parachute, Town of	5%	5%
Rifle, City of	16%	16%
Silt, Town of	4%	4%

Source: State of Colorado 2015d.

Note:
[a] 2011 State law allows counties to create a "Federal Mineral Lease District" designated by the county to receive direct distribution payments, which otherwise would have gone to the county government. The intent of the new arrangement is to allow a county to receive the payment allocated under the Federal PILT program without an offset for Federal mineral lease receipts.

Table 3.4.33 presents the shares of direct distributions to school districts whose operations are mainly in Garfield County. The Garfield RE-2 school district covers western Garfield County, except for Parachute and Battlement Mesa, which are in the Garfield 16 School District.

Table 3.4.33 Share of Cumulative Direct Distributions Received by School Districts in Garfield County Since 2009

Shares of Cumulative Distributions Since 2009	*Federal Mineral Lease Receipts to School Districts*
Garfield 16 School District	12%
Garfield RE-2 School District	47%
Roaring Fork RE-1 School District	40%

Source: State of Colorado 2015d.

Trend in Local Government Operating Expenditures

Tables 3.4.34 and 3.4.35 present operating expenditures for selected years for county governments in the three-county region and for selected cities and towns in Garfield County. The data are from budgets and from audited financial data by the State DLG, but are restated to be comparable across jurisdictions. Operating expenditures are for the ongoing activities of local government, principally general government, public safety, public works (primarily roads and sanitation), health, culture and recreation, and public welfare. Operating expenditures do not include debt service or capital outlays in support of those activities.

Table 3.4.34 Operating Expenditures for 2007, 2009, and 2013 in Garfield, Mesa, and Rio Blanco Counties

Millions of Nominal $	*2007*	*2009*	*2013*[a]	*Change from 2007 to 2013*
Garfield County	$49.5	$61.2	$73.6	49%
Mesa County	$95.5	$107.9	$95.9	NC
Rio Blanco County	$13.3	$26.9	$20.8	56%

Sources: State of Colorado 2015c; Garfield County 2013a; Mesa County 2013b; Rio Blanco County 2013.

Note:
[a] Data are from Garfield County 2013a, Mesa County 2013b, Rio Blanco County 2013. Restatement to be comparable to State of Colorado 2015c is by Lloyd Levy Consulting, LLC.

Key:
NC = no change.
Rio Blanco's total assessed value increased by ~$575 million from 2007 to 2013 while the O&G share declined whereas in Garfield county there was an ~$42 million increase in total assessed value compared to the ~$166.3 increase in O&G assessed value.

Table 3.4.35 Operating Expenditures for 2007, 2009, and 2013 for Selected Local Governments in Garfield County

Millions of Nominal$	*2007*	*2009*	*2013*[a]	*Change from 2007 to 2013*
Glenwood Springs	$15.8	$19.4	$18.8	20%
New Castle	2.9	3.0	3.3	14%
Parachute	1.4	1.9	1.6	15%
Rifle	8.5	10.1	10.6	25%
Silt	2.6	2.5	1.8	-33%

Sources: State of Colorado 2015c; City of Glenwood Springs 2013; Town of New Castle 2014; Town of Parachute 2013a,b; City of Rifle 2013; Town of Silt 2013.

Note:
[a] Data are from City of Glenwood Springs 2013, Town of New Castle 2014, Town of Parachute 2013a,b, City of Rifle 2013, Town of Silt, 2013. Restatement to be comparable to State of Colorado 2015c is by Lloyd Levy Consulting, LLC.

Factors related to the oil and gas industry and the general economy, the latter including the recession of late 2007 to 2009, are responsible for differences among the jurisdictions compared in Tables 3.4.34 and 3.4.34 and how the operating cost of government has changed in each in relation to population since 2007. The operating expenditures of Garfield County government grew 49 percent from 2007 to 2013, while the population of the county increased by 9 percent during the same period. The operating expenditures of Rio Blanco County government grew 56 percent from 2007 to 2013, and during the same period the population of the county increased by 11 percent. For comparison, the operating expenditures of Mesa County government increased through 2009, but declined again; therefore, by 2013, expenditures were at about the same level as in 2007. During the same period, Mesa County's population increased continuously and was 8 percent higher than in 2013 than in 2007.

Municipalities have had a similar experience, with the town of Silt as an exception. The operating expenditures of Rifle city government grew 25 percent from 2007 to 2013, while the population of the city increased by 8 percent during the same period. The operating expenditures of Parachute town government grew 15 percent from 2007 to 2013; during the same period, the population of Parachute was reduced by 1 percent. During the same period, the operating expenditures of New Castle town government increased by 14 percent, while population increased by 14 percent. Silt was an exception to the pattern of rising expenditures, with operating expenditures falling 33 percent from 2007 even as population increased by 15 percent because of the town's weak retail sales tax base. For comparison during the same period, the operating expenditures of Glenwood Springs, which is generally farther from active oil and gas development areas of Garfield County, increased by 20 percent, while population increased by 9 percent.

Public water and wastewater services are enterprises, meaning they primarily operate on fees for service; therefore, enterprises are not included in these tables of mainly tax supported government activities. Special districts or fire authorities that cover both the incorporated and unincorporated areas around communities provide fire and ambulance service near the Planning Area, except for inside the Glenwood Springs city limits, where there is a separate city fire department.

Property taxes and intergovernmental revenues generally support the fire and emergency services organized as special districts or fire authorities. In 2014 these consolidated and rural fire protection districts in Garfield County had the following property tax bases (assessed valuation): Carbondale and

Rural, $237 million; Colorado River (New Castle, Silt, and Rifle), $1.1 billion; De Beque (Garfield County part), $339 million; Glenwood Springs Rural (excludes city), $65 million; and Grand Valley (Parachute and Battlement Mesa), $1.1 billion (Garfield County 2014).

Energy/Mineral Impact Assistance

From 2005 to the present, the three counties of the region and local jurisdictions within the counties received cumulative grants of more than $126 million for capital improvements from the Colorado Energy/Mineral Impact Assistance Fund, which re-directs Federal mineral lease receipts. This amount was matched by $387 million of local revenue or additional intergovernmental or grant funding. This adds up to a commitment within the region for facilities development of about $514 million, or an average of $57 million per year over nine years, though the actual annual flow varied with circumstances.

Using the estimated 2013 population of the three-county region as a base (211,887 persons), this equates to $2,400 per capita (at cost) of additional capital facilities available to the current population of the three-county region. It also equates to $18,400 spent on new facilities per new resident region-wide, dividing the total funding amount by the change in the total population from 2000 to 2013. Table 3.4.36 shows these comparisons. The higher operating expenditures and expenditures of local government shown in Table 3.4.34 and Table 3.4.35 may be due to the cost to maintain new and expanded facilities and levels of service. An exception is the town of Silt, where expenditures have fallen to balance a budget that is revenue constrained.

Table 3.4.36 Cumulative Energy and Mineral Impact Assistance Program Awards and Matching Funds Committed to Facilities Construction and Improvements in the Three-County Region from 2005 to 2013

In Millions of Dollars Except as Noted, Dollars Not Adjusted for Inflation	*Garfield County*	*Mesa County*	*Rio Blanco County*	*Total*
Cumulative Awards 2005 to 2013[a]	$55.6	$47.1	$23.6	$126.4
Cumulative Match 2005 to 2013[a]	$191.2	$165.3	$30.7	$387.2
Cumulative Total Funding 2005 to 2013[a]	$246.8	$212.5	$54.3	$513.6
2013 Population (persons)	57,298	147,811	6,778	211,887
Population Change 2005 to 2013 (persons)[a]	8,042	18,812	960	27,814
Funds Committed to Facilities from 2005 to 2013 Per Capita Relative to 2013 Population (dollars)[a]	$4,308	$1,438	$8,010	$2,424
Funds Committed to Facilities 2005 to 2013 Per Capita Relative to the Change in Population from 2005 to 2013 (dollars)[a]	$30,693	$11,295	$56,552	$18,466

Sources: State of Colorado 2006b, 2007b, 2008c, 2009b, 2010b, 2011b, 2012b, 2013b, 2014, 2015a.

Note:
[a] Calculations by Lloyd Levy Consulting, LLC.

Payments in Lieu of Property Taxes and National Forest Payments

County governments in the three-county region also receive Federal "Payments in Lieu of (Property) Taxes" (PILT) intended to compensate for Federal land, which is tax exempt but still requires the provision of services by local government, especially road access. Table 3.4.37 shows the recent PILT payments to counties in the region, which are small compared to funds derived from the oil and gas

industry in recent years but are part of the counties' long-term funding base. These counties also receive small amounts (generally under $1 million a year) from the U.S. Department of Agriculture (USDA) Forest Service (USFS) under a separate Federal agency revenue sharing act, the Secure Rural Schools and Community Self Determination Act (SRS) of 2000; SRS earmarks funds for roads, bridges, and schools.

Table 3.4.37 PILT Payments to Counties in the Three-County Region

In Millions of $	*FY2014*	*FY2013*	*FY2010*[a]	*FY2005*[a]	*FY2000*[a]
Garfield County	3.026	2.825	0.391	0.808	0.768
Mesa County	3.354	3.127	0.512	1.561	0.949
Rio Blanco County	0.539	0.497	0.493	0.296	0.158

Sources: U.S. Department of the Interior 2013a, 2014a; U.S. Department of the Interior, n.d.

Note:
[a] The data came from the U.S. Department of the Interior, Payments in Lieu of (Property) Taxes, County Payments online data base (U.S. Department of the Interior, n.d.).

The formula for PILT payments follows acres of federally owned land, adjusted for county population. There is a deduction for payments to the county from other Federal programs. The actual amount appropriated for PILT by Congress may be less than the formula, reducing payments proportionately.

In the past, the receipt of Federal mineral lease revenue would offset a county's PILT. However, in 2011, Colorado authorized county Federal Mineral Lease Districts, which now receive Federal mineral lease receipts that would have offset PILT payments. Garfield, Mesa, and Rio Blanco counties have Federal mineral lease districts. These entities accept most of the Federal mineral lease revenue transferred to the county level and, in turn, make impact assistance grants to jurisdictions within the county.

Public School District Finance and Condition

The funding of Colorado public schools follows the official pupil count determined by a State formula, which differs from a "head count" at a given time. Adjustments raise a district's funding base according to local factors in relation to State trends in cost of living, overall size of the district, ability to meet a funding minimum, and incidence of at-risk students. Local property taxes contribute a share according to constitutional constraints and the ability of the State to fund the gap. Typically, the split between State and local funding is about two-to-one. When the recession lowered State revenue projections, beginning in 2009, Colorado began to reduce the amount of State aid to local districts because of lower revenue at the State level and because of legislative priorities. This negative factor adjusts the total program funding allowance; therefore, it affects the amount that a district may spend per pupil.

Few school districts serving Garfield County recorded indicators of fiscal stress from 2009 forward because of the national recession and trends in the oil and gas industry, according to Colorado's State-mandated fiscal stress analysis. In 2009, Rangely RE-4 (serving western Rio Blanco County and located in an oil and gas area separate from the Planning Area) encountered declining enrollment, less mineral lease and Rio Blanco County impact fee revenue, and cost increases, which led the district to close or consolidate schools and cut other costs. In 2010, De Beque 49JT (serving mostly the Mesa County part of the De Beque area, but also a small part of Garfield County) cut jobs or eliminated programs to balance its budget because of lower enrollment and, therefore, lower total funding. The issues for both districts were resolved by 2011 (State of Colorado 2009c, 2010c, 2011c).

3.4.3.9 Quality of Life

The Mesa State College Natural Resource and Land Policy Institute studied the effect of growth in northwest Colorado around 2008, around the height of the drilling boom. The study issued two reports, "The Socioeconomic Impacts of Growth" (Mesa State College 2007) and "Investigating Regional Collaboration in Northwest Colorado" (Mesa State College 2008).

These reports provide information on how local participants in interviews and focus groups understand quality of life and how they relate it to growth in their counties of residence, based on the experience during the 2005 to 2008 gas boom. The narratives presented in these reports often explicitly relate attributes of the boom to changes in quality of life and encompass a range of attitudes in the Study Area.

The analysis used this information because of its close connection to the growth experience in 2005 to 2008. The method was to search each document and extract the narratives directly associated with the term "quality of life." In this way, the analysis yields a strong impression of how these counties react to growth in terms of quality of life.

The first study (Mesa State College 2007) comprised a limited number of focus group meetings and interviews with government officials and business lenders. The study also collected secondary data. However, observations on quality of life from the interviews are the narratives useful for this assessment.

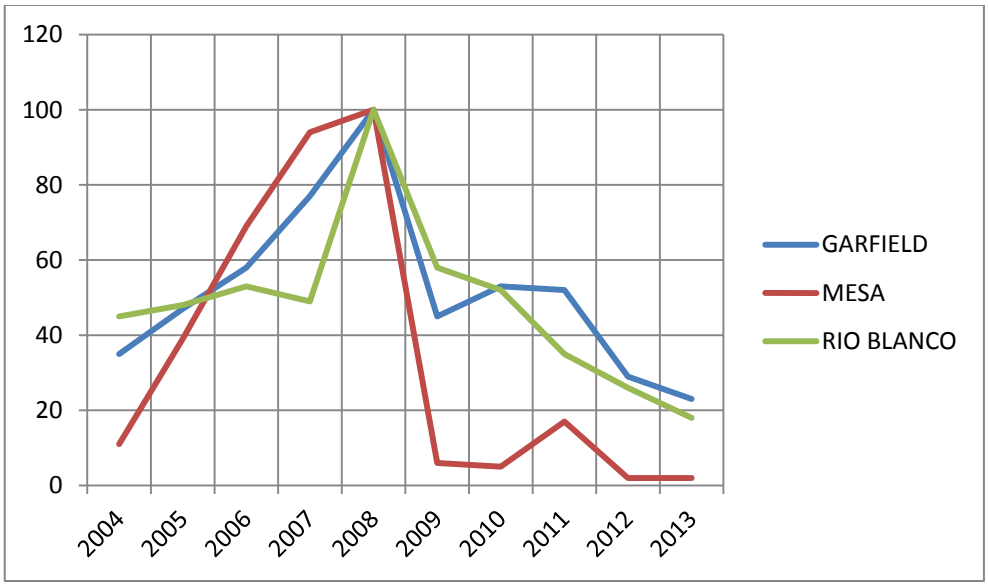
The second study (Mesa State College 2008) comprises focus group meetings with community leaders and a survey of area businesses in 2008. The study asked for respondents' observations on "the challenges posed by growth." Any narratives connecting challenges of growth to change in quality of life are useful for this assessment.

The geographical scope of the study was five counties in northwest Colorado, among them Garfield, Mesa, and Rio Blanco counties. The narratives used for this assessment are just those from Garfield, Mesa, and Rio Blanco counties.

The reports are a systematic study of the impacts of growth during the drilling boom. The information is contemporaneous, and the respondents were knowledgeable informants resident in northwest Colorado. The narratives directly reflect the time frame of the drilling boom. Assessing attitudes compiled in the reports should apply in anticipating the reaction in the region to growth triggered by potential oil and gas development in the future.

The availability of statistics from the period makes it a useful benchmark when paired with the qualitative information. As reported in sections above, population growth for the period ranged from 2.5 percent to 3.3 percent per year (Figure 3.4-1) and from 2000 to 2010, Garfield County population increased at an annual average rate of 2.6 percent per year (Table 3.4.7).

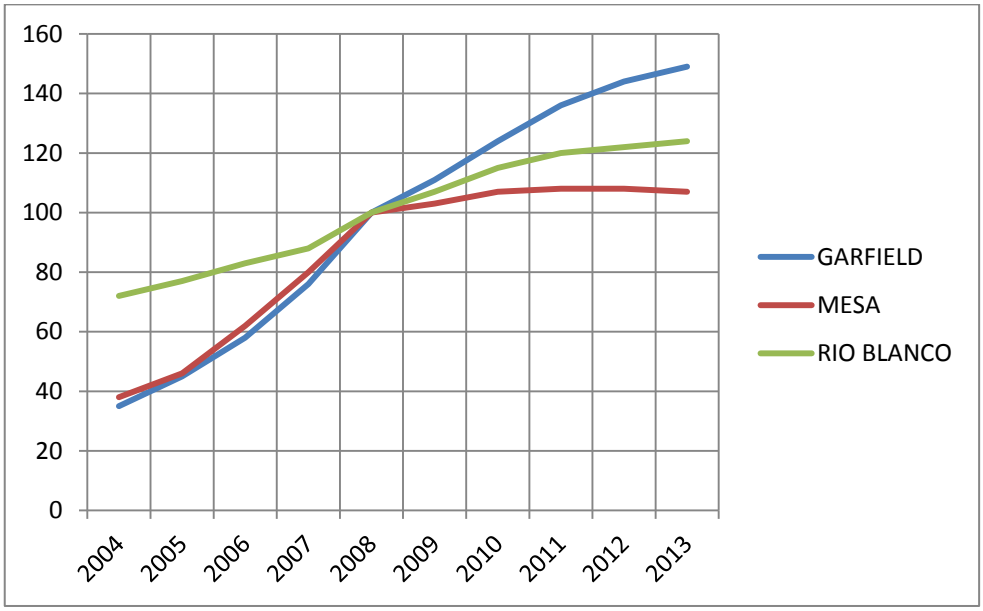
Paired with the population growth information are two fundamental measures of economic activity in the oil and gas industry of the region. Figure 3.4-16 shows the trend in oil and gas well "spuds" (i.e., the official start of drilling). Figure 3.4-17 shows the trend in the number of wells in production. The figures present the trends as an index with levels in the year 2008 represented by the index number 100, which is the peak year for drilling starts in all three counties in the region, Garfield, Mesa, and Rio Blanco.



Source: Stanczyk 2015.

Notes:
Indexed with levels in 2008 equal to 100.
Index calculations by Lloyd Levy Consulting, LLC.
"Spuds" recognize the official start of drilling as reported to the Colorado Oil and Gas Conservation Commission.

Figure 3.4-16 Index of Oil and Gas Well Drilling Activity ("Spuds," or Drilling Starts) in the Three-County Region from 2004 to 2013



Source: Stanczyk 2015.

Notes:
Indexed with levels in 2008 equal to 100.
Index calculations by Lloyd Levy Consulting, LLC.

Figure 3.4-17 Index of Growth of the Active Oil and Gas Wells in Place in the Three-County Region from 2004 to 2013

The numbers of well starts corresponding to the peak in 2008 (index number 100) in Figure 3.4-16 are 1,689 in Garfield County, 225 in Mesa County, and 204 in Rio Blanco County. The number of active wells corresponding to the index in Figure 3.4-17 increased in Garfield County from 2,940 in 2004 to 12,509 in 2013, in Mesa County from 661 in 2004 to 1,884 in 2013, and in Rio Blanco County from 2,619 in 2004 to 4,489 in 2013 (Stanczyk 2015).

Table 3.4.38 presents rig counts from a non-subscription source that includes comprehensive counts for counties only since 2011 (Baker Hughes 2015).

Table 3.4.38 Annual Average Rotary Drilling Rigs in the Three-County Region from 2011 to 2013

County	*2011*	*2012*	*2013*	*2014*
Garfield County	21	14	11	9
Mesa County	3	2	1	1
Rio Blanco County	4	2	2	2

Source: Baker Hughes 2015.

Note:
Averages calculated by Lloyd Levy Consulting, LLC.

Garfield County

According to the Mesa State College report, Garfield County respondents (described as "community leaders and local government officials") identified all of the following as characteristics of growth: "increase in population, increased diversity with an influx of illegal immigrants, booming economy, escalating demand for government services, housing shortage, labor force shortage, increased crime, demand on infrastructure including roads and bridges and waste water treatment." The report classified responses according to whether an aspect of growth was considered by respondents as having a positive effect on quality of life or a negative effect (Mesa State College 2007).

In Garfield County, aspects of growth classified as having a positive effect on quality of life were the expansion of the economy, expansion of the services and retail sectors, the development of shopping centers with stores that provide greater availability and selection of goods closer to home, a rise in sales tax and revenue from minerals property taxes which, in turn, enable local governments to provide additional services to residents, and the availability of high paying jobs with benefits for the whole family (Mesa State College 2007).

Aspects of growth identified by Garfield County narratives as having a negative effect to quality of life from growth were "the challenge" to the county's historical agricultural base from community growth, concern over "cultural changes" that manifest in lack of craftsmanship and pride in the work force, and conflict between “natives” and newer residents (Mesa State College 2007).

Although not directly related to quality of life specifically, respondent narratives explained that the county is split between the economies of the eastern part of Garfield County, which is affected by a mix of the resort and energy industries, and the western part where the energy industry is the primary economic driver. Respondents also noted that some growth in population has occurred throughout Garfield County from "the desirability of the area and people’s independence from having to live where they do business" (Mesa State College 2007).

Mesa County

In Mesa County, respondents' narratives identified the additional demand for workers by the natural gas industry, which generates higher income at all wage levels and across all industries, as the main aspect of growth associated with positive change in the quality of life (Mesa State College 2007). Negative effects of growth on the quality of life were identified by respondents in Mesa County as traffic volumes and congestion on main roads, inflation in food and housing costs, crowding in schools, and shortage of medical care for working age residents (Mesa State College 2007).

The Mesa County report indicates that some effects of growth in the natural gas industry arise from concerns that are negative for quality of life even though they may be independent of data. The narratives indicate that natural gas industry growth can be associated with a perception independent of crime statistics that the public is less safe, which is negative for quality of life (Mesa State College 2007). Growth in the extraction industry when it is located within Mesa County itself is associated with more attention to and awareness of air and water quality; this can raise levels of concern that are negative for quality of life, especially if there are incidents (Mesa State College 2007).

Rio Blanco County

In Rio Blanco County, aspects of growth classified as having a positive effect on quality of life are expansion of the economy, expansion of the services and retail sectors, development of shopping centers, greater availability and selection of goods closer to home, a rise in sales tax and revenue from minerals property taxes, the additional services taxes allow governments to provide to residents, and the availability of high paying jobs with benefits for the whole family (Mesa State College 2007).

In Rio Blanco County, respondents identified these characteristics of growth from the natural gas industry: increase in population, increase in the number of housing units, increase in traffic on roads, a "booming" economy, increased demand for services, housing shortage, labor force shortage, increase in school enrollment, increased crime, demands on public infrastructure, inflation, "and, in general, change." In Rio Blanco, the respondent narrative also tends to associate growth from the natural gas industry directly with a negative impact on quality of life, especially if energy development growth is "exploding" or out of scale with existing trends (Mesa State College 2007).

Tradition and Quality of Life in Northwestern Colorado

Summarizing across a five county region of northwestern Colorado, the report suggests that growth from the natural gas industry raises concerns among residents attached to places in the area by longevity or choice about loss of traditional characteristics and access to traditional resources. Actual change or concern that change may occur to these traditional values because of natural gas development is a negative for quality of life. The traditional values narrated by respondents include western agriculture, the rural "culture" associated with western Colorado agriculture, traditional agriculture's need for open and low cost land, and a "small town atmosphere." Concerns include potential loss of access to hunting and fishing places in the path of development and the appearance of drilling rigs and new road networks on traditional landscapes (Mesa State College 2007).

Business Community and Quality of Life

Narratives from business leaders suggest that attributes of quality of life that are positive for the business environment are urban facilities and services. These include amenities such as recreation centers, upscale restaurants, and more retail and urban infrastructure, all of which are said to help attract skilled workers (Mesa State College 2007). Overall, the narratives of respondent business leaders from northwest Colorado place quality of life in the middle range of priority (or importance) for the business

environment, as they do environmental issues, emergency services, the local economy, health care, and public schools (Mesa State College 2008).

3.4.3.10 Non-Market Values, Including Ecosystem Goods and Services

The Planning Area contains an inventory of marketable resources, primarily oil and gas, range, and water. Lessees pay the right to develop oil and gas or feed cattle on the range. Water from the Planning Area is used for irrigated agriculture, domestic use, and industrial use, the latter including oil and gas production, and Colorado water rights are increasingly a market commodity (Loomis 1993).

Non-Market Use and Non-Use Values

BLM land may also contain resources that possess non-market value, distinguished as either use value or non-use (also passive use) value. The use value of a non-market good is the value or benefit to the public from the resource's direct or indirect use. The public derives non-market value from the use of resources in the Planning Area by participating in activities such as recreational fishing, hunting, bird watching, and traveling through the area for viewing or for vehicle-based recreation. Section 3.5.3 describes a resource with the potential for having non-market use value.

Buying and consuming market goods and services, such as food, lodging, gas, and equipment, typically accompanies the use of resources like recreation that have a non-market use value. The consumption expenditures associated with the recreation use generates employment and income (i.e., economic impact) in surrounding communities (U.S. Department of the Interior 2014b).

BLM land may also possess resources providing non-use value to the public. The non-use, or passive use, value of a natural resource is its value beyond its current use. Passive use value may be one of three types: existence, option, and bequest. Existence value is the amount the public would be willing to pay to guarantee that the resource always exists. Option and bequest value is the amount the public would be willing to pay to conserve a resource for future use. If the future use is expected to occur within the same generation, the value is called an "option" value. If the use is expected to occur in future generations, the value is called a "bequest" value (U.S. Department of the Interior 2014b).

Resources with the potential for having non-market, passive-use value are described in Section 3.3.3, Special Status Plants and Significant Plant Communities, Section 3.3.4, Special Status Fish and Wildlife, Section 3.4.1, Visual Resources, Section 3.4.2, Cultural Resources, Section 3.5.7, Areas of Critical Environmental Concern, and Section 3.5.8, Lands with Wilderness Characteristics.

It is assumed that there is a non-market value for the use or passive use of the resources of the Planning Area. Specialists may be engaged to estimate and report these values when there is an opportunity to conduct research (Loomis 1993). However, quantifying non-market values is not always feasible for the BLM to perform during a planning process, and it has not been conducted for this assessment. Still, this does not preclude their consideration in the planning process (U.S. Department of the Interior 2014).

Ecosystem Services and Value

A separate source of value known as “ecosystem goods and services” includes a range of benefits from the existence of appropriate ecosystem structures and functions that promote human well-being. Ecosystem services are most often discussed at a macro scale, and sometimes even a global scale, but the scale of places producing ecosystem services can be small, as for a watershed where flood control is provided by intact wetlands. Some ecosystem services are commodities produced by nature but sold in markets; an example is forest timber production. Other ecosystem services, such as the flood control benefits from wetlands, do not commonly involve markets and, thus, reflect non-market values (U.S. Department of the Interior 2013b).

Ecosystem services fall under four types of goods and services: (1) provisioning (products obtain from ecosystems) (2) regulating (benefits obtained from regulation of ecosystem process); (3) cultural (non-material services obtained from ecosystems); and (4) supporting (services necessary for the production of all other ecosystem services) (Skrabis 2014). The first three types are final goods and services; the fourth type, supporting services, includes intermediate goods and services that combine to help produce the first three. All of these categories of ecosystem services reflect the assumption that natural areas provide benefits to people (Smyth, n.d.) and, thus, people may be willing to pay for them, even if they do not do that through the market economy.

The component of the BLM planning process most directly charged with preserving natural areas is the management of Areas of Critical Environmental Concern (ACECs) (Smyth, n.d.). Section 3.5.7, Areas of Critical Environmental Concern, describes four areas that met the criteria for inclusion in this RMPA/SEIS process. As noted above, quantifying values such as ecosystem services is not always feasible for the BLM to perform, but this does not preclude their consideration in the planning process (U.S. Department of the Interior 2014b, p. 3-238 and 3-239).

3.4.3.11 Population Forecast for the Planning Area

Population projections for 2040 from the SDO of the Colorado Department of Local Affairs forecast long-term growth for the three-county region (Table 3.4.39). Garfield County's population is forecasted to rise at the fastest pace, one percentage point higher than the rate forecasted for the State as a whole. Mesa County's population is forecasted to rise at a little faster pace than the State, and Rio Blanco County's population is forecasted to rise at about the same pace as the State as a whole. The projections in Table 3.4.39 are consistent with the employment projections presented in Figure 3.4-15 in Section 3.4.3.7.

Table 3.4.39 Population Forecast for Garfield, Mesa, and Rio Blanco Counties to 2040

Population Area	*2013*	*2040*	*Average Annual Change from 2010 to 2013*
Garfield County	57,298	108,000	2.4%
Mesa County	147,811	226,773	1.6%
Rio Blanco County	6,778	9,767	1.4%
Colorado	5,264,890	7,752,887	1.4%

Source: State of Colorado 2013c.

Note:
Percentages calculated by Lloyd Levy Consulting, LLC.

3.4.3.12 Environmental Justice

By Presidential Executive Order 12898, a Federal agency must identify "disproportionately high and adverse human health or environment effects of its programs, policies, and activities on minority and low-income populations." The assessment begins with identifying particular concentrations of minority and low-income persons who may reside in small sub-areas close to the Planning Area. The analysis considers small sub-areas because the presence of identifiable minority or low-income populations may not show up in averages calculated for larger geographical or political entities, such as a county or municipality. There are potential environmental justice communities in the Planning Area.

Table 3.4.40 presents the result of a screening analysis of minority and low-income population in the Census block groups of the Study Area. A block group in the Study Area may contain approximately 1,000 persons (perhaps 300 households), and it roughly approximates urban neighborhood scale. However, the analogy is inexact because the U.S. Census Bureau forms block groups for convenience in enumeration without considering their social character. The table includes only the specific block groups presenting a minority or low-income population. Each "population" is defined as either 50 percent of the block group population or 10 percentage points higher than the reference area, which is the average for three-county region.

Table 3.4.40 Environmental Justice Screening of Census Block Groups in the Three-County Region for 2010 Minority and 2013 Low-Income Populations

Population Area	*Total Population, 2010*	*Race and Hispanic Minorities as Percent of Total Population*	*Individuals in Poverty as Percent of Total Population, 2009-2013*
Colorado	5,029,196	30%	13%
Three-County Region	209,778	21%	14%
Garfield County	56,389	31%	12%
Block Group 1, Tract 9516, Garfield County	1,113	35%	NA
Block Group 2, Tract 9516, Garfield County	1,252	66%	NA
Block Group 1, Tract 9517.01, Garfield County	778	44%	48%
Block Group 3, Tract 9517.01, Garfield County	1,019	38%	32%
Block Group 1, Tract 9517.02, Garfield County	738	39%	28%
Block Group 2, Tract 9518.02, Garfield County	1,276	50%	NA
Block Group 1, Tract 9518.03, Garfield County	1,172	62%	NA
Block Group 3, Tract 9518.03, Garfield County	1,324	49%	42%
Block Group 1, Tract 9518.04, Garfield County	1,525	49%	NA
Block Group 1, Tract 9519.02, Garfield County	2,222	36%	NA
Block Group 2, Tract 9519.02, Garfield County	1,760	32%	NA
Block Group 1, Tract 9520.01, Garfield County	2,178	43%	25%
Block Group 2, Tract 9520.01, Garfield County	2,983	41%	NA
Block Group 2, Tract 9520.02, Garfield County	616	38%	40%
Block Group 6, Tract 9520.02, Garfield County	961	41%	NA
Block Group 1, Tract 9521, Garfield County	1,238	42%	34%
Number of block groups in Garfield County	36	10 block groups with minority population	4 block groups with minority population
Rio Blanco County	6,666	14%	15%
Block Group 2, Census Tract 9511, Rio Blanco County	507	19%	41%
Number of block groups in Rio Blanco County	6	1 block group with minority population	1 block group with minority population

Table 3.4.40 Environmental Justice Screening of Census Block Groups in the Three-County Region for 2010 Minority and 2013 Low-Income Populations

Population Area	*Total Population, 2010*	*Race and Hispanic Minorities as Percent of Total Population*	*Individuals in Poverty as Percent of Total Population, 2009-2013*
Mesa County	146,723	17%	15%
Number of block groups in Mesa County [a]	88	3 block groups with minority population	16 block groups with low income population

Sources: U.S. Census Bureau 2010c, 2013c.

Note:
[a] This analysis does not identify individual block groups in Mesa County because of their distance from the Planning Area.

Key:
NA - Low income percentage is lower than the cutoff for identifying the block group as having a low income population.

In Garfield County, 16 block groups out of 36 in 2010 had a minority population, with concentrations ranging from 35 percent to 66 percent minority compared to a three-county region average of 21 percent. Seven block groups in Garfield County had low-income populations, as measured by survey data compiled by the U.S. Census Bureau from 2009 through 2013; the concentrations range from 25 percent low-income to 48 percent compared to the three-county region average of 14 percent. Garfield County as a whole was 31 percent minority in 2010 compared to 21 percent minority in the three-county region, meaning that Garfield County as a whole possesses a substantial minority population.

Rio Blanco County had one block group out of six presenting both a minority and low-income population. Mesa County had three block groups out of 88 presenting a minority population and 16 block groups presenting a low-income population.

3.4.4 Transportation

Information describing the Affected Environment for transportation is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed as well as updated road ownership and maintenance information.

3.4.4.1 Major Highways and Access Roads

A network of Federal, State, and County roads provides access to the Planning Area and serves to define the area's boundaries. I-70 defines the southern boundary of the Planning Area, bringing traffic to the region from throughout the United States. Colorado SH 13, which forms the eastern boundary of the Planning Area, carries traffic to and from Rio Blanco and Moffat counties to the north. Garfield CR 215, the road along Parachute Creek, defines the western border of the Planning Area.

US Highway 6, originally the major east-west route through the region, is now essentially a frontage road for I-70. From US Highway 6, Garfield CR 246 provides access into the Sharrard Park area and specifically Garfield County's Anvil Points Landfill facility. Access beyond CR 246 transitions across private oil and gas development roads that serve various well pad sites. The existing road to the old Anvil Points Oil Shale Mine facility perched alongside the steep cliffs has controlled access with a locked BLM gate, which limits travel on this poorly maintained road to administrative uses. Access beyond the County

road up along the mine portal road is prevented by a locked BLM gate, which limits travel on this poorly maintained and hazardous road to administrative uses.

Garfield CR 215 was paved during the oil shale exploration boom of the 1980s and currently provides access to industrial facilities and private lands along Parachute Creek. The northern terminus of CR 215 is at locked gates at the inactive Unocal oil shale property, the property is owned by EnCana Oil & Gas (USA) Inc. and managed as the North Parachute Ranch supporting numerous operating wells, access roads, facilities and gas gathering pipelines. Access to the top of the plateau through Unocal Encana, Chevron, WPX, and other private properties is readily available on existing field development roads provided owners grant permission for use of the roads. These routes could be directly used in conjunction with oil and gas development atop the plateau and with minor improvements would be usable by drill rig equipment. Public access to the western side of the planning area is nonexistent; public comments during a scoping meeting in Parachute indicated frustration by some members of the public that they could not access the top of the plateau on these roads but, instead, must drive two hours to reach the top of the plateau on publicly accessible routes. The easternmost portion of CR 242 is no longer maintained by county as public is encouraged to use CR 244 south across Hubbard Mesa to SH 13 bypass.

The two primary routes providing public access to BLM lands atop the plateau are: (1) northwest from Rifle on SH 13 bypass to CR 244 (Fravert Reservoir), which crosses Hubbard Mesa for approximately 2 miles, joins CR 242 (JQS Road), and climbs the eastern face of the Roan Cliffs to Rim Road on top; and (2) farther north on SH 13 to CR 5 (Piceance Creek Road) at Rio Blanco, then west approximately 3 miles to Cow Creek Road, which travels southerly about 12 miles from the turnoff from CR 5 to the rim. In Rio Blanco County, Cow Creek Road is a BLM road that provides public access, through private land easements, about 12 miles from the turnoff from CR 5 to the rim. When it crosses into Garfield County, Cow Creek Road becomes CR 249 providing a lengthy, yet winding main access road across the rim of the plateau connecting with numerous arterial BLM routes which typically follow east-west ridge top alignments generally passable to passenger cars during inclement weather conditions

While the JQS Road provides the shortest public access to the top of the plateau, it is very steep, narrow, and winding, becomes impassable during inclement weather, and normally requires a high-clearance, four-wheel-drive vehicle. In comparison, access from the north, up Cow Creek Road, is much longer but generally passable to passenger cars during all but the worst weather conditions. This difficult access to the top of the plateau keeps overall vehicle use lower than on surrounding public lands. Traffic on JQS and Cow Creek Roads is mostly for recreation or ranching.

Table 3.4.41 provides average daily traffic counts for Planning Area access roads at significant locations in and near the Planning Area. It also shows traffic counts projected to occur at the same locations for the year 2023.

The traffic counts for I-70 and SH 13 are from Colorado Department of Transportation (CDOT), which counts or estimates Average Annual Daily Traffic (AADT) for all Federal and State highways in Colorado. The AADT numbers represent the average over an entire year (CDOT 2006). The Garfield County numbers are for May to October 2002 (BLM 2006). Counts for Rio Blanco CR 5 at SH 13 are for the first two weeks of September 2002 (BLM 2006). The CR 5 count shows much less use of Cow Creek Road, even during hunting season.

Table 3.4.41 Average Annual Daily Traffic (AADT) on I-70 and Other Roads

Highway or Road Segment	*Average Daily Traffic*	
	2003	*Projected 2023*
I-70 at Rifle	11,402	15,393
I-70 at Rulison	15,954	21,538
I-70 at Parachute	11,580	15,633
SH 13 at I-70	11,680	15,768
SH 13 at US 6	2,151	2,904
SH 13 at SH 325	3,049	4,116
SH 13 at CR 5	1,963	2,650
CR 215 (Parachute Creek)	919	1,241
CR 242 (JQS)	84	113
CR 244 (Fravert Reservoir)	317	428
CR 246 (Anvil Points)	366	494
CR 5 (at SH 13) (Rio Blanco County)	300	405

Projected traffic volume increases for 2023 are based on CDOT assumptions. CDOT has projected traffic growth for all roads within its jurisdiction over the next several years using an annual growth rate based on historic population trends. This annual rate of 1.5 percent amounts to a 35 percent increase across a span of 20 years. The cumulative growth rate was applied to the current County road totals to arrive at projected 2023 traffic volumes.

The projections are intended to provide a background scale against which impacts may be measured. However, while the projected 35 percent growth in traffic reflects a number of ongoing trends (e.g., growth in interstate traffic, population growth, increase in local industrial and business activity), it may be low. The State Demographer projects a 66 percent growth in the local population for roughly the same period, which could result in substantially higher traffic counts on State and County roads.

Average daily traffic at the Rulison interchange is much higher than either the Rifle or Parachute interchanges. A considerable amount of oil and gas field traffic is directed from the Rulison interchange based on Garfield County's Preferred Haul Route designations. Such route planning could provide some rationale for the increase in vehicle numbers at the Rulison interchange when compared to the vehicle numbers at the other two population centers. The high average daily total for SH 13 at I-70 reflects the combination of local traffic and traffic exiting or entering I-70 for access onto SH 13 and US Highway 6. Data for SH 13 at SH 325 are for the first major road juncture intersection north of Rifle, where SH 325 diverges northeastward to the Rifle Gap and Rifle Falls areas.

3.4.4.2 BLM Roads and Trails

The transportation management objective in the GSRA RMP (1984, revised 1988) is "to provide access to public land by acquiring those legal rights on non-public land that are essential to implement BLM planned actions." The access management objective in the WRRA RMP (BLM 1996a) is to "enhance access to public lands and resources." The road management objective in DOE's OMP for NOSRs 1 and 3 is to plan "road maintenance and construction to provide adequate administrative access to the NOSRs and to minimize erosion or watershed damage."

BLM roads and trails provide public and administrative (agency and permittee/lessee) access to public lands and in-holdings of private land within the 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. Most use of BLM roads would be described as casual; however, oil and gas development roads typically receive daily use.

Road system management has focused on maintaining major access roads, which generally receive most of the recreation traffic. Corrective maintenance occurs as problems are identified and funds permit. Road construction has been limited to improving or upgrading segments of road to improve access or to alleviate maintenance or environmental problems. The NOSR OMP of 1988 stated that the NOSR road system was maintained and new roads constructed where needed to provide administrative access to the NOSRs. DOE funded road maintenance and construction only as required for DOE programs. Any roads that were abandoned were to be obliterated and revegetated to reduce further use and damage.

Existing roads and trails in the Planning Area are categorized based on the type of use and maintenance they receive (Table 3.4.42).

Table 3.4.42 Roads and Trails in the Planning Area1

Type	*Miles*
Full-sized vehicle routes	91
Foot/horse routes	83
Administrative routes (designated as foot/horse for public use)	55

Note:
[1] Does not include small segments of primary or secondary highways within Planning Area edges (4.5 miles).

3.5 MANAGEMENT ENVIRONMENT

3.5.1 Lands and Realty

Information describing the Affected Environment for lands and realty is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed.

3.5.1.1 Introduction

The land tenure objective in the 1984 GSRA RMP is “to increase the overall efficiency and effectiveness of public land by identifying public land suitable for disposal through public sale (Category I lands) and suitable for continued management under multiple-use concepts (Category II lands).” The utility and communication facility management objective in the 1984 GSRA RMP is “to respond, in a timely manner, to requests for utility and communication facility authorizations on public land while considering environmental, social, economic, and interagency concerns.”

The land use authorizations objective described in the 1997 WRRA RMP is “to make public land available for the siting of public and private facilities through the issuance of applicable land use authorizations, in a manner that provides for reasonable protection of other resource values.” The land tenure adjustments objective in the 1997 WRRA RMP is “to provide for adjustments in land ownership to acquire important resources/values, meet local needs, resolve unauthorized uses, and improve efficiency in land management”. The objective is “to eliminate unnecessary segregations of public lands.”

About 67,000 acres, or 53 percent of the land within the Planning Area, are managed by BLM. Most (about 56,000 acres) were transferred from the jurisdiction of DOE in 1998. Table 3.5.1 describes land ownership in the Planning Area.

Table 3.5.1 Land Ownership in the Planning Area

Ownership	*Surface Estate (acres)*	*Percent of Area*	*Mineral Estate (acres)*	*Percent of Area*
Federal (BLM NOSR 1)	34,600	27.3 %	36,200	28.6 %
Federal (BLM NOSR 3)	19,260	15.2 %	20,000	15.8 %
Other Federal (BLM)	12,920	10.18 %	17,410	13.9 %
Subtotal Federal (BLM)	**66,780**	**52.6 %**	**73,800**	**58.2 %**
Private	**60,110**	**47.4 %**	**53,090**	**42.0 %**
Total	**126,890**	**100 %**	**126,890**	**100 %**

Note:
Numbers do not always add up because of slivers of overlap and rounding.

In addition to the surface land managed by BLM, the Planning Area includes more than 7,020 acres of split-estate lands in which the surface is privately owned but the Federal government has retained the mineral estate. NOSRs 1 and 3 were created by Executive Order on December 6, 1916, and September 27, 1924, respectively, and were to be managed "for the exclusive use and benefit of the United States Navy," with the intention that fuel produced from oil shale would be for the use of the United States Navy. The NOSRs were removed from the operation of public land laws, except at the discretion of the Navy, and were managed by the Navy and then by DOE until passage of the Transfer Act that shifted jurisdiction of NOSRs 1 and 3 to BLM.

As described in Chapter 1 of this Draft RMPA/SEIS, the Transfer Act directed BLM to manage the transferred lands in accordance with FLPMA and other laws applicable to public lands. The first action required under that directive is this RMPA, the purpose of which is to establish BLM's management direction for the transferred lands.

3.5.1.2 Withdrawals

A withdrawal is an action that removes an area of public land from one or more normal public land uses in order to protect a specific potential use of the land. A withdrawal restricts an agency's ability to manage its lands under multiple use management principles. The restrictions generally segregate the lands from some or all the public land laws and some or all of the mining and mineral leasing laws for a specific period of time, generally 20 years for post FLPMA (BLM 2001f).

The most frequent use of this authority is to withdraw an area from mineral entry (i.e., to remove land from the normal operation of the Mining Law of 1872, which permits individuals to explore for minerals, "locate" a mineral source, develop the mineral, and eventually "patent" the mineral location and acquire ownership from the Federal government). In northwestern Colorado, a substantial amount of public land was previously withdrawn from mineral entry to protect the oil shale resource. Withdrawal may prohibit any other action, such as a land exchange, that could lead to transfer of title from the United States.

The Secretary of the Interior is authorized to make, modify, extend, or revoke withdrawals. The BLM may recommend to the Secretary of the Interior that lands be withdrawn or the withdrawal on lands be revoked. Recommendations are part of the land use planning process and this Draft RMPA/SEIS. If the

land use plan recommends withdrawal or withdrawal modification, extension, or revocation, BLM must prepare documents that describe the withdrawal/revocation/modification, the reason for the withdrawal/revocation/modification, and what the effects would be. This is generally conducted using a NEPA EA. For this SEIS, withdrawal/revocation/modification is further addressed in Chapter 4, Environmental Consequences.

The Executive Orders that created NOSRs 1 and 3 withdrew them "from settlement, location, sale, or entry." However, most oil shale withdrawals in northwestern Colorado were revoked in 2002 by Public Land Order No. 7516 (67 FR 51 [2002]) after it was determined that current public land laws and regulations provide adequate protection of the oil shale resource in those areas. Similarly, revocation of the withdrawal on the transferred lands would allow multiple-use management of the land. However, continued withdrawal of the Anvil Points Facility Repositories would be necessary to prevent potential conflicts of use that could prove detrimental to current and future use of those lands as repositories.

Oil shale is now a leasable mineral resource (Mineral Leasing Act, Section 21, as amended 1982), similar to coal or oil and gas, and its development can be managed like other minerals in the context of multiple-use management. The Transfer Act transferring jurisdiction of NOSRs 1 and 3 from DOE to the BLM did not revoke the original withdrawals. Approval of the Secretary of the Interior is required to revoke withdrawals, or to open the withdrawn lands to uses other than those specified in the Executive Orders.

Currently, NOSRs 1 and 3 are withdrawn from the Mining Law of 1872, which results in no entry to the area for mineral exploration or development, other than oil and gas. The Anvil Points Oil Shale Facility Repositories 1, 2, and 3 have additional restrictions on their use through ROWs granted to BLM.

3.5.1.3 Land Tenure Categories

BLM classifies all of its public lands into three categories with regard to their potential for disposal or retention:

- **Category I (Disposal)** – Judged suitable for disposal by sale, usually because they are small, isolated tracts that cannot be effectively managed;
- **Category II (Exchange)** – Managed for multiple-use and cannot be sold, but can be exchanged for other properties or made available for disposal under the terms of the Recreation and Public Purposes Act. Applications under this Act are considered on a case-by-case basis. Applications under the Desert Land Act or General Allotment Act of 1887 are rejected in Category II lands; and
- **Category III (Retention)** – Must be retained to satisfy a specific management requirement. Public lands designated as a WSR or ACEC would be placed in this retention category.

The 1984 GSRA RMP classified the approximately 56,000 acres of NOSRs 1 and 3 as Category III lands because the withdrawals that created them made disposal impossible. Approximately 2,240 acres, identified as Parcels 11, 12, 13, 14, 15, 20, 21, and 22, were classified as Category I lands. The remaining lands in the Planning Area were classified as Category II.

BLM may acquire land through exchanges with other entities. In-holdings may be acquired if they become available for purchase or exchange.

3.5.1.4 Land Use Authorizations

For enduring surface-disturbing uses of public lands that are not within the scope of the mining laws and regulations, BLM issues leases and ROWs. Leases are primarily used for the benefit of local

governments, special districts, or public groups in accordance with the terms of the Recreation and Public Purposes Act (R&PPA). The Rifle Sportsmen's Club currently has expressed an interest in an R&PPA lease on about 40 acres of BLM land behind their target range west of the town of Rifle.

The most common form of authorization to permit uses of public lands by commercial, private, or governmental entities is the ROW, which is used to permit private and public roads that cross public lands, pipelines not within the boundaries of an oil and gas lease, public utilities, communications facilities, reservoirs, and a variety of other purposes. Pipelines and utilities associated with an oil and gas drill pad are located within the disturbed areas of existing access roads to the greatest extent possible. If that is not possible, they may be located within 50 feet to either side of the centerline of the access road. Within the Planning Area, most existing ROWs are located west of and parallel to SH 13 along the eastern boundary of the Planning Area. These include multiple electric transmission lines and natural gas pipelines. Closer to Rifle, the pipelines leave the SH 13 corridor and proceed south across Hubbard Mesa toward I-70.

The transferred lands include no formal BLM ROWs, although two communications sites are located on these lands. A USFS site near the Rim Road may be put under a specific authorization. A Garfield County communications site located near the portal of the oil shale mine at Anvil Points is unauthorized. The disposition of this communications site is dependent, in part, on what happens to the oil shale portal access road.

No ROWs have been issued for use of Rim Road. However, the road provides access to existing gas wells on private property and is the only feasible route to those wells.

3.5.2 Travel Management

Information describing the Affected Environment for travel management is carried forward from the Roan FEIS.

3.5.2.1 Current Management

Travel management is aimed at providing adequate access to BLM 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. All public lands are required to be designated as "open," "limited," or "closed" to OHVs (43 CFR 8342.1). In "open" areas, cross-country travel by motorized or mechanized means is not limited. "Open" designations are primarily used for areas that have been selected for intensive OHV recreation and that do not have compelling resource protection needs, user conflicts, or public safety issues that warrant limiting cross-country use. On lands designated as "limited," cross-country travel is prohibited and travel is limited to specified routes. The network of routes available and the terms and conditions of use on those roads and trails are usually identified on published maps. In "closed" areas, no motorized or vehicle use is permitted. Cross-country travel by foot or horse is usually permitted in all areas regardless of OHV designation. Snowmobiles traveling over the snow may also be permitted.

The 1984 GSRA RMP designated most lands in the resource area as open to OHVs, including all of the public lands within the Planning Area that were not managed by DOE. Neither the GSRA RMP nor DOE's OMP set travel designations on NOSRs 1 and 3. Following the transfer of jurisdiction from DOE to the GSFO, route inventories were conducted, and the initial Roan Plateau Map and Visitor Guide (BLM 2000a) was published in 1998. Although public comments on the routes available for travel were requested at the time the visitor guide was published, no comments were received.

In 2000, interim travel designations were formally put in place on the transferred lands and the visitor guide was reprinted (Federal Register 65(128):41081-41082; July 3, 2000). In an effort to curb the expanding use of cross-country travel by OHVs and to prevent further proliferation of unplanned routes, motorized and mechanized travel was limited to designated routes year-round. The limitation did not apply to foot or horseback travel or to snowmobiles operating on snow.

These interim travel designations are a temporary measure to prevent further damage to resources caused by unplanned cross-country travel and to allow time for open, careful discussion about travel designations through the integrated planning process. Permanent OHV designations for the transferred lands, including specific road and trail designations, will be made as part of this Draft RMPA/SEIS process. OHV designations on the other public lands in the Planning Area will be reviewed to ensure compatibility with management objectives.

Within the WRRA, motorized vehicle travel is managed to provide for public needs and demands, protect natural resources, provide safety to users, and minimize conflicts between various user groups. Public lands within the WRRA portions of the Planning Area are included in the interim travel order (Federal Register; July 3, 2000; cited above). Adjacent public lands to the north (Cow Creek/Timber Gulch/Hay Gulch) are closed from August 15 through November 30 each year in order to establish a non-motorized quality hunting area. The travel designations from this Draft RMPA/SEIS will be incorporated into the WRRA RMP.

Scoping comments, from public scoping in 2000, seemed to indicate that the interim travel designations have general public support, but that some conflicting issues remain. Participants in the scoping process expressed the desire for BLM to:

1. Reduce the number of vehicle routes in order to enhance the backcountry experience, decrease fragmentation of wildlife habitat, lessen wildlife displacement, and curb riparian impacts;

2. Maintain the current designations, because OHV driving is a traditional use and little if any change is needed;

3. Designate the already heavily used areas as “open;”

4. Designate a mechanized and motorized route system with opportunities for a variety of skill levels because an open cross-country play area is inappropriate;

5. Enhance hunting success by introducing seasonal restrictions or a reduction in the number of routes, thereby reducing motorized disturbance of big game;

6. Reclaim routes that are troublesome, redundant, unneeded, or cause resource damage; and

7. Find a way to incorporate a greater level of partner involvement in travel management.

3.5.2.2 Current Use

There are two TMAs in the Planning Area: the Hubbard Mesa OHV Open Area, 2,330 acres; and the 64,450-acre Roan TMA (Map 36).

Lands Atop the Plateau

Public access to the Roan Plateau is limited to two routes. From SH 13, visitors can travel the steep and narrow JQS Road, or use the Cow Creek Road via the Piceance Creek Road. The JQS Road is impassable

when wet, and both accesses are closed by snow in the winter. This lack of convenient access keeps overall vehicle use lower than on surrounding public lands. BLM currently maintains the JQS Road and the main ridge roads on the Roan Plateau. Other routes are maintained as needed, usually in conjunction with maintaining livestock improvements.

Atop the plateau, travel routes tend to be a mixture of high clearance and four-wheel-drive, two-track routes. Historically, recreational OHV use has benefited from the extensive road system, but nothing was specifically done to enhance travel and access for motorized or non-motorized recreation. Almost all routes are dead ends that terminate at livestock water developments or are user-created and end at a viewpoint or stream access point.

Mountain bikers currently use the existing road system. BLM cooperated with the City of Rifle to develop a mountain biking brochure and map, but has done little on the ground to enhance mountain biking. Given the increasing population in the region and the growing popularity of this sport, it is reasonable to assume that mountain bikes will become more common in the Planning Area as the presence of suitable routes and an attractive landscape become better known. Hikers and horseback riders generally travel cross-country or on the few livestock trails. Snowmobile use remains low. Besides recreation, the current motorized route system provides access for livestock management.

Lands Below the Rim

In the southern foothills of the Planning Area, private land and terrain restrict travel and access. Only landowners, or those with landowner approval, can access and travel on private lands. Vehicle routes in this area are often associated with oil and gas production.

In contrast, public lands and the open pinyon/juniper vegetation of Hubbard Gulch and Hubbard Mesa allow easy access and cross-country passage for OHVs. Over time, this has resulted in a widespread system of rough and challenging roads and trails. Because they are so close to the town of Rifle and remain open throughout the winter, the Hubbard Gulch and Hubbard Mesa areas are popular destinations for recreational driving. Many of the routes also cross onto private lands. Private landowners have done little to discourage trespassing, such as erecting fences or signs, and many users probably do not realize when they are on private property. The commingled public and private lands make managing travel difficult.

As the population of the area has grown, so too has mechanized and motorized recreation. BLM has issued several special recreation permits for mountain bike events. Stakeholders and landowners have complained about the open travel designations (cross-country travel) and raised concerns about resource damage to soils, vegetation, wildlife, aesthetics, and conflicts with other recreational users. The trend toward increasing mechanized and motorized use, and the associated problems that have occurred in recent years, are expected to continue.

3.5.3 Recreation

Information describing the Affected Environment for recreation is carried forward from the Roan FEIS. Information has been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. New information regarding recreational shooting in the Planning Area is also integrated.

Recreational opportunities in the Planning Area offer quality-of-life enrichment opportunities for residents and visitors. Steady population growth in local communities has increased recreational demands on adjacent, undeveloped public lands as visitors and nearby residents seek diversity of recreational opportunities. Recreational settings in the Planning Area range from backcountry (e.g., the East Fork Parachute Creek area) to rural (Hubbard Mesa). Recreation management has been primarily custodial, allowing visitors dispersed recreation opportunities.

3.5.3.1 Factors Creating Recreation Management Challenges

Colorado's population has grown significantly in the past 15 years, and has grown 6.5 percent between 2010 and 2014 (U.S. Census Bureau 2015). As a result, an increasing number of people are living near recreational areas or seeking undeveloped public land for recreational use. In addition, Colorado remains a popular destination for tourists, especially those seeking recreational experiences in an undeveloped setting. As a result, public lands administered by BLM are absorbing this increased recreational use (BLM 2000b). Other factors creating recreation management challenges include:

- Changing population demographics (U.S. Census Bureau 2015);
- Increasing dispersed recreation use, both summer and winter;
- Popularity of public lands as a local recreation destination for local communities;
- Adjacent private lands and in-holdings;
- Economic and social value of recreation and tourism;
- Recent public interest in, and growing awareness of, the area;
- Citizens' desire for a greater role in the management of their public lands;
- Budget allocations, which are flat or decreasing despite aging facilities and increasing demands;
- Technological advances, such as ATVs and mountain bikes, as well as better outdoor equipment and clothing;
- Integrating recreation use with sustainable management of other resources; and
- Trespassing on private lands by OHV users while recreating on adjacent public lands.

3.5.3.2 Resource Condition and Characteristics Atop the Plateau

Activities

A 1973 report to the Secretary of Defense noted that a most visitors come to the Roan Plateau for big game hunting, and an increasing number of visitors come to enjoy the scenery and natural beauty while camping, scenic driving, rockhounding, and hiking. The report also noted that snowmobiling may become popular as greater recreational demands are anticipated in the near future.

The recreation capability analysis for the 1984 GSRA RMP included NOSR lands. The NOSR Capability Unit was estimated to receive 3,100 recreation visits annually, mostly associated with hunting. Visitor use was expected to rise as the local communities grew. High values for viewing scenery and moderate values for hunting, wildlife viewing, hiking, sightseeing, and general dispersed recreation were recognized.

Dispersed, unstructured activities, such as fishing, hiking, camping, birding, sightseeing, mountain biking, OHV/ATV riding, and snowmobiling, are all popular today. Big game hunting remains the most popular activity. As a dispersed recreational activity, hunting is not limited to specific areas. However, in some areas, such as on top of the plateau and along the rugged side slopes, hunting becomes concentrated because of prime big game habitat.

Public participation indicated that the Planning Area is now an important supplier of all these activities and that people want to see little if any change to current activity opportunities.

Recreational Settings

The Recreation Opportunity Spectrum (ROS) is both a classification system and a prescriptive tool for recreation planning, management, and research (Clark and Stankey 1979). The recreational settings affect and sometimes determine the activities, experiences, and attainment of other ensuing beneficial and adverse outcomes. The ROS concept recognizes that the attainment of desired recreational experiences is heavily influenced, and sometimes actually determined, by the physical, social, and administrative settings of a recreational area (BLM 2002a). Appendix E describes the ROS classes.

During the recreation capability analysis for the 1984 GSRA RMP, visitors had expressed a preference for more primitive settings, while hunters preferred a variety of primitive and roaded settings.

The landscape of the Planning Area appears generally natural, even though numerous vehicle routes bisect the Roan Plateau. The creek bottoms and forested hillsides offer the best opportunities for solitude. No developed facilities exist, but primitive, dispersed campsites abound. The level of visitor management and regulation is low. Visitor services consist of informational signage at a few key locations, route signage, and a visitor brochure/map.

The evidence of people, including both sights and sounds, remains low in the Planning Area. The social setting has become more crowded, especially during the hunting season, but remains less crowded than surrounding public lands. This is probably due to the Planning Area's geographic isolation and the existence of only two public access roads: the steep and winding JQS Road from the southeast and, from much farther north, the more accessible Cow Creek Road.

Scoping for this RMPA/SEIS indicated a wide and somewhat conflicting desire for recreational settings. Some commenters want to close roads and remove human intrusions to enhance backcountry settings. Other comments suggest that people want little if any change in the current settings, especially if it would involve significant reductions in motorized travel and access.

Experiences and Outcomes

Scoping also indicated that the current recreational settings and activities are desired because they offer opportunities to explore, experience solitude, enjoy natural aesthetics, experience the challenge of driving on rough backcountry roads, rest mentally and physically, relieve stress, renew spiritually, maintain personal health, and maintain an outdoor-oriented lifestyle. Hunting was specifically mentioned for providing positive economic contributions to the local economy (BLM 2000c).

3.5.3.3 Resource Condition and Characteristics Below the Rim

Activities

Areas at lower elevations of the Planning Area contrast sharply with the steep Roan Plateau sideslopes. The area is a popular local destination that receives year-round use. Recreational activities are typically dispersed and unstructured, and include OHV riding and mountain biking, camping, hiking, horseback riding, hunting, and target shooting. Motorsports activities are dispersed throughout the area. However, Hubbard Mesa has been the dominant use area, presumably due to its terrain, accessibility, and proximity to Rifle. Popular trails may lead users to trespass unwittingly onto private land.

Target shooting occurs mostly in the Hubbard Mesa area. Concerns and complaints by visitors and neighbors are often centered on unsafe and indiscriminate shots fired by the participants and the trash they leave behind. The Rifle Gun Club operates a private shooting range 2 miles northeast of Rifle off CR 244.

Recreational Settings

Outside of the areas currently leased for oil and gas production, the foothills of the Roan Plateau have a high degree of naturalness, offer opportunities for solitude, and have only a few public vehicle access points because of terrain and private property (see the Wilderness Suitability section of the AMS [BLM 2002a]). Livestock and game trails offer minimal access into this arduous country, which consequently receives little visitation.

The landscape below the cliffs is visually and physically much more modified by visitor use and traversed by many rough double-track and single-track vehicle routes. Undeveloped, dispersed campsites abound, and no developed facilities exist. The level of visitor management and regulation is low. Informational signing is in place at a few key locations. Interaction among visitors/users is more frequent than on top of the plateau. Conflicts are emerging between adjacent landowners and livestock operators and motorized and mechanized trail users.

The area continues to experience signs of inappropriate use (trash dumping, litter, partying). In some areas, overuse creates conflicts with other recreational uses and adversely affects soils, vegetation, wildlife, and aesthetics.

The physical landscape is now much more developed with increasing numbers of user-created roads and trails. The social setting is more crowded, and evidence of people (litter, trash, party spots, etc.) is common. Field observations confirm that visitation peaks during spring and fall weekends. BLM still manages the area for dispersed, undeveloped recreational opportunities with minimal investment in facilities or personnel.

Experiences and Outcomes

Scoping for this RMPA/SEIS indicated that current recreational settings and activities are desirable because they offer an important recreation amenity close to town where users can take a break from everyday responsibilities, enjoy physical exercise and outdoor aesthetics, and benefit from the challenges of both motorized and non-motorized recreation. In addition, scoping indicated that motorized sports, specifically, provide positive economic contributions to the local economy (BLM 2000c).

3.5.3.4 Current and Projected Recreational Use

Tourism by visitors throughout the nation is significantly influenced by big game hunting, opportunities for motorized sports, and scenic destinations such as the East Fork Parachute Creek Falls. These activities and the natural settings with roaded access attract visitors from all over the nation.

Visitors participating in other activities are more local or regional in nature. The Roan Plateau area is viewed as a regional recreational amenity by residents from fast-growing towns along I-70, from Glenwood Springs to Grand Junction. No statistics exist, but stakeholders agree that recreational use will continue to increase with the growing local population, increased marketing, and word of mouth.

The CRVFO does not have statistics on dispersed visitor use trends for the Roan Plateau area. Field observations and traffic counters indicate the big game hunting seasons bring most visitors to the top of the plateau in the fall. In 1995, the adjacent White River National Forest was ranked fifth for total recreation visitor days in the National Forest System (USFS 2002).

3.5.3.5 Tourism

The Planning Area is located in Colorado's northwestern tourism region. Tourism is currently centered on hunting and motorized sports. Marketing has generally focused on the White River National Forest and opportunities elsewhere in the region (Colorado Tourism Office 2002).

Local marketing of hunting and wildlife viewing opportunities in the Planning Area is increasing; BLM has not played a role in marketing. Two outfitters offer guided big game hunting in the area, and the City of Rifle publishes a mountain bike guide for the Roan Plateau. The Planning Area also plays host to special recreational events. These activities currently provide positive economic contributions to the towns of Rifle, Silt, New Castle, Meeker, and Parachute, as well as Garfield County. Visitors tend to purchase meals, daily food supplies, fuel, sporting goods, gifts, and some lodging. Future growth in population and recreation presents opportunities for tourism to increase its contribution to the stability of the local and regional economy.

Other regional recreation providers of developed and dispersed recreation opportunities include:

- NPS – Colorado National Monument;
- USFS – White River National Forest and Grand Mesa-Uncompahgre National Forest;
- BLM – Grand Junction Resource Area;
- CPW – Garfield Creek and Christine State Wildlife Areas;
- Colorado Division of Parks – Rifle Falls, Harvey Gap, and Rifle Gap State Parks; and
- City of Rifle – Rifle Mountain Park.

Private recreation facilities, such as campgrounds and guest ranches, operate on nearby private land and public land.

3.5.3.6 Recreational Shooting

Littering, unsafe target shooting, and illegal dumping have become major issues on Federal lands where recreational shooting occurs. The BLM generally relies on the public to find safe locations to shoot, and clean up their targets and other debris. Many shooters leave behind broken clay pigeons and spent shotgun shells, as well as metal, plastic, and glass objects brought out for use as targets. Shooters erroneously get blamed for household dumping because home appliances discarded on Federal lands are used as targets and left in place. Environmental and property damage (shooting at trees and signs) is also a significant problem.

Recreational shooting occurs at several areas within Hubbard Mesa year round. The most popular areas for recreational shooting are along the first mile and a half of the Fravert Reservoir road. Within the Planning Area the Rifle Sportsmen's Club operates a private non-profit shooting range for members; and 15 minutes north of the City of Rifle, Colorado Parks and Wildlife operates a shooting range at the West Rifle Creek State Wildlife Area. There are no BLM-approved target shooting sites on BLM lands.

As recreation use has increased in the planning area so has the number of complaints about dispersed shooting, especially in the popular Hubbard Mesa OHV Area. It is a historic area where people have gone to do all types of shooting activities. However, recreation users are more frequently asking BLM to address shooting conflicts and reduce the potential of an accidental shooting.

3.5.4 Grazing and Rangeland Management

Information describing the Affected Environment for grazing and rangeland management is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed.

3.5.4.1 Current Management

Livestock management was permitted by DOE on the NOSRs, providing it did not interfere with programs or management objectives associated with oil shale exploration and research. Grazing was managed to maintain and prevent deterioration of NOSR soils, vegetation, watershed, and wildlife habitat. Since 1997, livestock have been managed to meet or exceed Land Health Standards.

Livestock grazing is managed, as described in the 1981 Rangeland Program Summary (BLM 2002a). Forage allocations from the summary will continue until sufficient data exist to require their modification. Monitoring studies will continue to evaluate livestock grazing levels. Range improvements continue to be used to improve rangeland conditions. Integrated activity plans, including NEPA analysis, will be developed for all allotments within the activity plan boundaries.

Four cow camp cabins are located in allotments above the rim: three in the East Fork Common Allotment, and one in the JQS Common Allotment. BLM has title to these cabins since they are facilities built on public lands, but BLM assigns maintenance responsibility to permittees through grazing authorizations or cooperative agreements.

3.5.4.2 Characteristics and Setting

Characteristics and setting for livestock management and rangeland health are described in the AMS (BLM 2002a) and summarized below. Grazing allotment locations and sizes are illustrated on Map 31.

Twenty-two grazing permittees are authorized on 16 allotments, including a portion of the Government Creek Common Allotment east of SH 13. Most of these are small, family operations. A total of 64,840 acres of public lands (10,246 AUMs [8,026 cattle and 2,220 sheep]) are available for grazing. Approximately 4,462 cattle and 8,200 sheep graze the area. The amount of revenues received varies from year to year depending on the grazing fee and the amount of active use, with an average of about $14,500 per year.

Most permittees have cow/calf and ewe/lamb operations and are highly dependent on the forage resources available on the allotments. On top of the plateau, the allotments serve as summer range for livestock operations. Below the cliffs, the allotments serve as spring, early summer, fall, and winter ranges for livestock operations. Livestock grazing allotments are administered under three management categories:

- Improve (I) – Managed to improve current unsatisfactory resource conditions and receive the highest priority for funding and management actions;
- Maintain (M) – Managed to maintain current satisfactory resource conditions and actively managed to ensure that resource values do not decline; and
- Custodial (C) – Managed custodially while protecting existing resource values.

These categories are designed to concentrate public funds and management efforts on allotments with the most significant resource conflicts and the greatest potential for improvement. In the Planning Area, seven allotments are in the “I” category, five are in the “M” category, and four are in the “C” category.

Table 3.5.2 summarizes allotments within the Planning Area in terms of size, current livestock use, and management categories.

Table 3.5.2 Current Livestock Use on Grazing Allotments in the Planning Area

Allotment Number	*Allotment Name*	*Allotment Category* [1]	*Public Land Acreage*	*Number/Type of Livestock*	*Season of Use*	*AUMs* [2]
06015	Gordon Gulch/ Naval Oil Shale (WRFO)	I	2,600	1,000 Sheep	05/03 to 06/30 10/01 to 10/25	344 197
06019	Cow Creek (WRFO)	I	1,320	350 Cattle	06/15 to 10/01	795
08905	Doodlebug	C	960	--	--	--
08912	Sharrard Park [3]	C	2,430	--	--	--
08913	Mahaffey Summer	M	1,840	400 Cattle	07/06 to 10/15	510
08914	Old Mountain	I	1,330	150 Cattle	06/15 to 10/15	164
08918	Wheeler Gulch [4]	C	550	--	--	--
08924	Cottonwood Gulch	C	9,640	180 Cattle	05/11 to 06/05	132
18039	Government Creek Common	M	160	1,500 Sheep 218 Cattle	03/18 to 03/31 05/16 to 06/15	138 222
18901	Magpie Creek	M	2,080	60 Cattle	06/16 to 10/17	56
18902	Webster Park	M	7,830	1,000 Sheep 1,000 Sheep	04/05 to 06/15 11/01 to 11/30	95 39
18903	Hubbard Mesa	I	6,860	60 Cattle 1,500 Sheep	05/16 to 06/15 04/1 to 05/31	61 301
18907	Rees	M	3,050	416 Cattle 416 Cattle	05/01 to 06/01 10/15 to 11/30	162 238
18908	JQS Common	I	10,410	660 Cattle 1,200 Sheep	06/16 to 09/30 06/16 to 09/30	2,607 559
18909	Clough-Alber	I	5,300	1,000 Sheep 134 Cattle	06/20 to 10/01 06/16 to 10/15	547 537
18910	East Fork Common	I	8,480	634 Cattle	06/16 to 10/15	2,542

Notes:
[1] Allotment Category: I = improve, M = maintain, C = custodial
[2] AUM (Animal Unit Month) = for cattle: one weaned or adult animal for one month; for sheep: five weaned or adult animals for one month.
[3] Sharrard Park is not allotted.
[4] Wheeler Gulch has not been allotted since 1986. A grazing transfer was initiated in 2001 for four cattle AUMs from 4/16 to 5/31.

3.5.4.3 Resource Condition and Capabilities Evaluation

Allotments Atop the Plateau

Gordon Gulch/Naval Oil Shale

Upland areas in the allotment are meeting the standards for upland sites. The Naval Oil Shale pasture has the most productive rangeland sites due to a combination of well-developed soils and higher precipitation. Riparian standards are being met with current management.

Cow Creek

An Ecological Site Inventory was conducted prior to the compilation of the Roan FEIS and the results indicated that 2 percent of the entire allotment, not only BLM lands) were at Potential Natural Community (PNC); 24 percent were at late-seral stage, 63 percent were at mid-seral stage, and 11 percent were at early seral stage.

Mahaffey Summer

Due to limited water sources and the steep drainage and topography, proper livestock distribution has been difficult to achieve for this allotment. A series of pit reservoirs constructed in the uplands has helped to improve livestock distribution. The grazing period on the allotment is from July 6 to October 15. The allotment is divided into three to five pastures and season-long grazing on any one area is not allowed. This grazing system should provide for adequate rest and recovery periods to maintain vegetative health. Data from 1992 indicate an upward trend in the allotment. Inspections indicate that utilization levels are within acceptable limits. Land health assessment and monitoring data indicate that range condition has improved since the 1981 Soil and Vegetation Inventory Method (SVIM) inventory for both upland and riparian vegetation. Seral stages within the allotment indicate good to excellent condition (toward late-seral stage or PNC).

The riparian habitats on First Anvil Creek, Sheep Trail Hollow, and Trail Gulch were evaluated at PFC in 1999. East Fork Parachute Creek, Pump House Gulch, Forked Gulch, and Cottonwood Gulch were not evaluated in 1999. In general, riparian areas seemed to be recovering, although not yet in PFC. The riparian areas are infested with bull thistle and houndstongue. Kentucky bluegrass, a non-native pasture grass that behaves as a weed, is also abundant.

Old Mountain

The Old Mountain Allotment was rested in 2001. The allotment contains riparian areas along Forked Gulch and West Forked Gulch, and a 1999 PFC analysis rated both as FAR with an upward trend. Although the Old Mountain Allotment shows a 4-month period of grazing use, rotational grazing is practiced in conjunction with private land, and grazing use occurs for only one month during the period between June 16 and October 15. The one-month period allows ample grazing rest and recovery time for riparian plant species. The upward trend rating is probably indicative of current grazing management on the allotment. The grazing authorization also has a utilization limit stipulation that further protects the riparian area.

Land health assessment and monitoring data indicate that range condition has improved since the 1981 SVIM inventory for both upland and riparian vegetation. Seral stages within the allotment indicate good to excellent condition. Livestock drift has been a concern in the riparian areas; however, the requirement of better fence maintenance on allotment boundary fences and more compliance checks should help alleviate the problem.

JQS Common

For this allotment, a lack of upland water sources has contributed to poor livestock distribution in the past, with livestock grazing concentrated in the riparian habitat along the streams. An Allotment Management Plan (AMP) completed in 1985 and revised in 1993 changed the grazing rotation system and set utilization and basal coverage objectives for key upland areas of the allotment.

A PFC analysis was conducted in 1994. Riparian objectives were added to the AMP, and numerous measures were implemented to improve livestock management in riparian habitats on the JQS Common Allotment. It appears that these measures have been successful. Riparian monitoring conducted in 1998

indicated that almost all of the riparian areas were improving. The only riparian habitats evaluated as static in 1998 were Middle Trapper Creek, Golden Castle Gulch, and Upper JQS Gulch. No riparian habitats were found to be declining.

The 1999 Land Health Assessment noted that range condition has improved since the 1981 SVIM inventory for both upland and riparian vegetation. The creeks were either at PFC or FAR, with an upward trend indicating improvement in the riparian areas. Seral stages in upland areas within the allotment indicate good to excellent condition. The most recent monitoring report indicated that riparian conditions may be on a declining trend (Fresques 2002).

Clough-Alber

Monitoring data indicate light utilization levels have occurred in the past on upland sites. Apparent-trend studies indicate static to upward trends throughout the allotment. Grazing distribution and management is a concern on this allotment, which is grazed season-long and has no pasture rotation system.

The 1999 Land Health Assessment and other monitoring data indicate that range condition has improved since the 1981 SVIM inventory for both upland and riparian vegetation. Seral stages within the allotment indicate good to excellent condition. Since the most recent monitoring, riparian condition in this allotment was observed to exhibit a declining trend (Fresques 2002).

East Fork Common

A lack of upland water sources has contributed to poor livestock distribution in the past, with livestock grazing concentrated in the riparian habitat along the streams. The 1984 AMP set utilization and basal coverage objectives for key upland areas in the allotment. In 1986, pasture configurations changed from a four-pasture rest rotation system to a three-pasture deferred rotation system. The three-pasture system was preferable because it eliminated the pasture fence that ran down the middle of Ben Good Creek, allowing grazing in the riparian zone from two different pastures. Permit renewals conducted in 2001 established utilization objectives for riparian areas and adjusted utilization objectives for uplands. Monitoring data indicates that utilization objectives have been met with current management, with slight to light moderate utilization of key species.

Changes in riding and salting practices, removing fences along creek bottoms, and developing upland water sources have helped to bring about some improvement in upland and riparian conditions. Observations in 1986 and 1990 indicated a static trend in condition. Some evidence of upward trend was apparent in 1992.

The Land Health Assessment indicated that the creeks are either at PFC or FAR with an upward trend. Land health assessment and monitoring data indicate that range conditions have improved since the 1981 SVIM assessment for upland and riparian vegetation. Seral stages within the allotment indicate good to excellent condition (late-seral stage).

Allotments Below the Rim

Doodlebug

The upland assessment site in the Doodlebug Allotment showed good diversity in the vegetative community. Grasses and forbs looked healthy and productive, but the shrubs were heavily hedged and showed signs of stress from big game use. Upland vegetation Land Health Standards, associated with Healthy Plant and Animal Communities, was met in this allotment. The Land Health Assessment data indicate that range condition is moving toward mid- to late-seral stage. No other monitoring data are available.

Sharrard Park

This allotment has not been grazed since 1990 when the permittee gave up the permit due to the landfill and gas developments. The 1984 GSRA RMP indicates that 23 AUMs are an appropriate stocking level for this allotment due to suitability factors such as forage condition and terrain available for grazing. The 1981 SVIM and 1984 GSRA RMP indicate the allotment is in poor to fair condition (early to mid-seral stage). A Land Health Assessment conducted in 2004 (BLM 2005b) concluded this allotment met, or was moving towards achieving, Land Health Standards. However problem areas were identified in terms of meeting Land Health Standard, associated with Healthy Plant and Animal Communities.

Wheeler Gulch

No livestock grazing has been authorized on this steep, poor condition allotment since 1986, and no monitoring data have been collected since 1985. Utilization studies conducted in 1985 and 1986 indicated that slight to light utilization occurred on key forage plant species. Allotment inspections at the time indicated that the forage condition in the allotment was poor. Prior to 1986, 37 cows and 56 AUMs were allocated for the allotment. However, the 1984 GSRA RMP indicates that eight AUMs are an appropriate stocking level for this allotment due to suitability factors such as forage condition and terrain available for grazing. Earlier monitoring data, plus the 1981 SVIM inventory, indicate the allotment is in early to mid-seral stage (poor to fair condition). A Land Health Assessment conducted in 2004 (BLM 2005b) concluded this allotment met, or was moving towards achieving, Land Health Standards with no problem areas.

Cottonwood Gulch

Select sagebrush benches in this allotment contain some perennial grasses; however, undesirable plants, such as cheatgrass and snakeweed, are abundant. The allotment shows evidence of poor grazing management in the past, and problems have been noted with cattle trespassing from the adjoining private land. However, in recent years, grazing management has improved and the vegetation condition appears to be improving, as well. A 1995 riparian survey indicates the riparian areas in the allotment are in static to improving condition. A 2004 PFC assessment rated most riparian habitats as PFC. A 0.6-acre segment of Cottonwood Gulch was rated as FAR with an upward trend. The causal factor for the FAR rating was road encroachment (BLM 2005b). The allotment is grazed from May 11 to June 5, which provides an adequate re-growth period for upland and riparian vegetation. In the sagebrush and salt desert scrub communities, the understory is still dominated by annuals, but perennials are present in the interspaces and appear to be increasing. Utilization levels in 2001 vary from slight to moderate, which is meeting the utilization standard of 50 percent. Earlier available monitoring data indicate that range condition is moving toward good to excellent. A Land Health Assessment conducted in 2004 (BLM 2005b) concluded this allotment met, or was moving towards achieving, Land Health Standards. However, problem areas were identified in terms of meeting Land Health Standard, associated with Healthy Plant and Animal Communities.

Government Creek Common

Data from the 2001 Land Health Assessment indicate that upland vegetation Land Health Standards, associated with Upland Soils and Healthy Plant and Animal Communities (habitat for wildlife) were not being met at all locations.

Magpie Creek

Data from the 2001 Land Health Assessment indicate that upland vegetation Land Health Standards, associated with Healthy Plant and Animal Communities, were met at all locations. This indicates the range condition is moving towards a mid- to late-seral stage. No other monitoring data are available.

Webster Park

Utilization data collected in 1996 and 2001 indicate that the 50-percent utilization standard for upland vegetation is being met for this allotment, with the exception of heavy utilization levels occurring near or at a gas well in 2001. A 1992 apparent trend study indicated a static trend at one key area. In addition, 1993 browse studies indicate slight to light utilization on sagebrush, with the exception of heavy utilization at one site. The age classes ranged from young to mature to decadent with some recruitment. A 1995 riparian survey indicates an intermittent gulch is in declining condition.

A Land Health Assessment was completed in the Goodrich Park area in 2001. Other available monitoring data indicate that cheatgrass is abundant in the western part of this allotment, and perennial grass cover is poor. Based on seral stages, range condition is good in the eastern part of the allotment (Goodrich Park) but poor to fair in the western part. The better condition in Goodrich Park may reflect the fact that this area is grazed only from March 1 to April 30, so no grazing occurs during the growing season. A Land Health Assessment conducted in 2004 (BLM 2005b) concluded this allotment met, or was moving towards achieving, Land Health Standards. However problem areas were identified in terms of meeting Land Health Standard, associated with Healthy Plant and Animal Communities. This allotment has been converted from cattle grazing to sheep grazing.

Hubbard Mesa

An allotment evaluation written in 1996 describes concerns with vegetation resources, particularly browse conditions and utilization levels on sagebrush species. The utilization levels were attributed to both mule deer and sheep. The evaluation also expressed concerns regarding low diversity of grass and forb species. Browse utilization, poor browse recruitment, and understory diversity on public land parcels surrounding private land and portions of Cook Gulch are still a concern in the allotment. The poor browse recruitment and understory diversity may be the results of past livestock practices, heavy use by deer during winter, and the naturally low potential of these sites. In December 1996, a Livestock Use Agreement, which governs sheep use in the allotment, was signed by the BLM and the permittee.

The 2001 permit renewal EA noted that widespread and increasing vehicle use is a concern in the allotment, especially in Home Ranch and Cook Gulch. The EA also noted that sagebrush stands are decadent and encroachment by Utah juniper and pinyon pine trees is probably due to fire suppression.

The 2001 Rifle Creek Land Health Assessment indicated that this allotment was not meeting Land Health Standards. Range condition has remained static or declined since the 1981 SVIM. Livestock grazing was determined to be a significant contributing factor and short-term management actions were implemented in 2002 to prevent further decline in the resource condition. Long-term management actions will be implemented by 2005 with the objective of making substantial progress toward meeting all Land Health Standards.

Rees

This allotment is meeting Land Health Standards. In 1990, the allotment was converted from sheep grazing to cattle grazing during a transfer of grazing privileges. The Land Health Assessment data indicate the range condition is moving towards mid- to late-seral stage. No other monitoring data are available.

3.5.5 Oil and Gas Leasing and Development

Information describing the Affected Environment for oil and gas leasing and development is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning

Area spatial data since the Roan FEIS was completed. New data and information from the revised RFD have been integrated.

The Planning Area lies within an area of the CRVFO in central Garfield County with high natural gas and oil potential. This area is generally considered the southernmost extent of the Piceance Basin. The geology of the Planning Area is described in detail in Section 3.2.1.

Within the region, most of the natural gas that is currently being produced is from the Wasatch Formation and Mesaverde Group. The Wasatch Formation is a thick sequence of variegated shales and sandstones and represents a mixture of fluvial, alluvial, and piedmont deposits. Depth to the Wasatch in the lower part of the Planning Area is about 3,500 feet. The Mesaverde Group is divided into the Iles Formation (including Rollins, Corcoran, and Cozzette sandstone members) and the overlying, massively stacked, lenticular, non-marine Williams Fork Formation (including the Cameo Coal Zone). Early Mesaverde gas development was primarily in the Cozzette and Corcoran sandstones. For the last 15 years or more, virtually all gas production has been from the Williams Fork Formation.

The Williams Fork Formation comprises 1,500 to 4,000 feet of tight sands, shales, and coals. The sands are point-bar deposits stacked into a composite of meander-belt reservoirs, each 20 to 60 feet thick and about 1,500 feet wide, with considerable internal discontinuity. Williams Fork wells vary in depth from around 5,000 to 10,000 feet, and the wells currently being drilled in the lower portion of the Planning Area are generally in the middle of that depth range. From the top of the Roan Plateau, depth to the Williams Fork includes another 2,000 to 3,000 feet of overlying sediments.

Over the last 15 years, production from this area has created evidence of substantial reserves in the Planning Area. Recently acquired lands above the rim have the same geologic zones as the immediately adjacent producing areas to the south; therefore, it is reasonable to expect that comparable reserves will be found above the rim. No oil and gas development of the Federal mineral estate has taken place above the rim; however, Barrett Resources drilled and developed seven gas wells on private land in the early 1990s. These were Wasatch wells, and production from these wells has been minimal. No wells have been drilled since then on private property above the rim. Approximately 24 well pads were used by DOE for exploring the oil shale reserves and for hydrological investigations are present above the plateau. These old pads are often mistaken for oil and gas exploration pads.

Although most of the hydrocarbon development discussed in this RMPA/SEIS consists of natural gas, some oil is also produced with the gas and would continue to be captured.

3.5.5.1 Drilling and Production

The rate of drilling and production in the Planning Area both increased and decreased since 2000. Through the 2000s, wells spudded (i.e., wells that began drilling operations) in the Planning Area ranged from 59 per year to 450 per year, with most of those located below the rim. Since 2010, the number of wells spudded has dropped considerably and averaged 120 per year from 2010 through 2012. Only 14 wells were spudded above the rim during that time. As of September 2013, approximately 2,800 wells were drilled within the Planning Area.

Production within the Planning Area is characterized by three producing gas horizons: the Mesaverde Formation, the Wasatch Formation, and a small amount from the Mancos Formation. According to IHS Enerdeq, there are 2,766 active wells in the Planning Area and according to COGCC data there are 2,661 active wells in the Planning Area. This difference is possibly due to data entry lag (Appendix G). Approximately 2,600 wells are in the Mesaverde Formation, 90 in the Wasatch Formation, five from the Mancos Formation, and two others. Approximately 890 (33 percent) were on the Federal mineral estate lands. As of September 2013, the Mesaverde Formation was the most prolific, with 1.74 trillion cubic feet

(TCF) (96.7 percent of the total), while the Wasatch Formation totaled 56.17 billion cubic feet (BCF) (3.1 percent of the total) and the Mancos Formation totaled 2.83 BCF (0.2 percent of the total) (Appendix G). Gas production from the Mesaverde Formation increased steadily from the 1980s through the late 2000s, dropping off slightly after 2008. Wastach Formation gas production peaked in the 1990s and has declined slightly over the years. Gas production in the Mancos Formation began in the early 2000s and has been variable, with a low in 2008 but then peaking in 2011.

Of the existing 890 wells on Federal mineral estate lands, 30 were drilled by DOE in an area referred to in the Transfer Act as the "developed tract of NOSR 3." This drilling was initiated to protect Federal gas resources from drainage by offset operators. Six of the well pads were dual locations (two wells per pad). DOE also entered into joint ownership/operation, or "communitization," agreements with private developers for approximately 25 to 30 additional wells. The wells drilled by DOE and those in which the United States shared an interest in are located in the southern portion of the Planning Area. When the developed tract of NOSR 3 was leased in 1999, the facilities on those properties were sold to the lessee.

The largest producer in the region is WPX Energy Rocky Mountain LLC, which is currently developing reserves on Federal and private lands in the southern portion of the Planning Area at an approved downhole spacing of 10 acres. Most of the leases currently being developed for oil and gas in the region are approved for 10-acre spacing. Little gas development has occurred in the WRRA portion of the Planning Area. EnCana Oil and Gas is actively developing the Williams Fork Formation in the White River dome area west of Meeker in Rio Blanco County, Colorado, and Exxon-Mobil is working in the Mesaverde Group of the Piceance Creek Unit.

3.5.5.2 Recoverable Resources

The Planning Area includes 126,890 acres, of which 73,800 acres are Federal mineral estate (including split-estate) and 53,090 acres are private mineral estate. Approximately 34,510 acres of the Federal mineral estate is currently leased. The estimated technically recoverable gas resource within the Planning Area is 17,730 BCF (17.7 TCF), with the Federal mineral estate contributing 10,295 BCF (58 percent) of this total. This represents ultimate gas recovery assuming all land within the Planning Area can be developed. Reasonably Foreseeable Development (RFD) (Appendix G) estimates the actual producible resource at 10,920 BCF and 14,938 MBO (or "thousand barrels of oil") within the Planning Area, and 5,935 BCF and 8,066 MBO within the Federal mineral estate for the 20-year planning period.

3.5.5.3 Directional and New Technology Drilling Practices

Directional drilling in the Planning Area and surrounding area occurs in the large majority of new wells, as it allows access to reservoirs from locations that are not directly over the reservoir, as well as the concentration of wells, facilities, roads, and associated surface disturbance in a single (and often smaller) area. Steep slopes or canyon (riparian) bottom areas may necessitate directional drilling to locate wells on mesa tops. Lease line locations and spacing may also force a directional drilling situation. While new well pads are still being constructed, extensive use of directional drilling to multiple downhole locations from existing pads is also occurring. According to IHS Enerdeq (2013), 2,181 wells drilled in the Planning Area are S-curve directional wells and only 578 wells in the Planning Area are vertical wells (BLM 2014b).

Operators in the CRVFO have directionally drilled as many as 52 wells from one pad (Webb 2005). Many wells spudded before the year 2000 were drilled vertically, but with the advent of more advanced completion techniques and with bottom hole densities at 10 acres for the Williams Fork Formation, the future will involve multi-well directional drilling from a single pad. Encana Oil & Gas (USA), Inc., proposed 60 wells on the WF H15 596 pad (BLM 2011). In the north Parachute field area, lateral reaches of the bottomhole location from the surface hole location are able to approach 4,877 feet (Webb 2005).

This kind of offset is dependent on the geology and reservoir characteristics, and most of the directional drilling within the CRVFO has a lateral reach around 2,500 feet. Economics is a major consideration because directional drilling is generally more costly than drilling vertically, and gas reserves need to be significant enough to recover costs in a reasonable amount of time and at a reasonable rate of return (Appendix G).

Slim-hole (diameter <6”) drilling and completion, coiled tubing applications, high-energy gas fracturing, and new methods of well stimulation are currently being used within and around the Planning Area and may play a part in an increased number of wells being drilled. These technologies make it more practical to explore in moderate- to high-risk wildcat areas. Slim holes cost less than large-diameter wells because the smaller rigs require less transportation and site preparation. In addition, the smaller wellbores record faster drilling times and have less expensive drilling tools, casing, and cement jobs.

3.5.5.4 Horizontal Drilling Practices

Currently only seven (0.25 percent) of the wells in the Planning Area are horizontal wells. According to IHS Enerdeq, six horizontal exploratory wells were drilled into the Mesaverde Formation group in the Planning Area and one horizontal well was drilled into the Mancos Formation. Operators have since determined that horizontal drilling in the Mesaverde Formation group is not appropriate based on the Mesaverde geology (Appendix G).

To the west and south of the Planning Area, operators have begun drilling horizontal wells into the Mancos Formation. In general, the operators drill horizontal wells with 1-mile horizontal legs that produce significant amounts of natural gas. The development is still exploratory, and operators are attempting to determine the best drilling and completion practices for horizontal Mancos Formation development. While it is possible to drill some formations up to almost 2 miles, this is dependent on geology and is not realistic throughout the Planning Area.

3.5.5.5 Leasing

BLM holds quarterly lease sales of the oil and gas resource in accordance with the Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA). An oil and gas lease gives the lessee the right to extract the resource and to occupy as much of the leased surface as needed for extraction. The lessee may conduct any activities necessary to develop and produce natural gas from the lease area, including drilling wells, building roads, and constructing pipelines and related facilities. Although the initial lease term is 10 years, it may be extended indefinitely as long as the lessee demonstrates that the lease is capable of producing oil or gas in paying quantities. Extended leases are considered “held by production.” Unleased parcels, or parcels for which the term has expired without development, may be requested by industry for inclusion in a new quarterly lease sale.

With the passage of Public Law 105-85, which transferred NOSRs 1 and 3 from DOE to BLM in 1998, the unleased mineral estate managed by BLM was increased by 56,540 acres. A 1999 lease sale required by Public Law 105-85 resulted in the lease of 8,379 acres of the newly acquired mineral estate. The remaining Federal mineral estate has not yet been leased, and this RMPA/SEIS will determine whether that area will remain closed or be made available to leasing—and under what stipulations, Lease Notices (LNs), or other restrictions. Table 3.5.3 shows the acreages of leased and unleased Federal mineral estate in the Planning Area as of April 8, 2015. Most of the existing leases in the Planning Area are held by production and are likely to remain so until the recoverable resource has been extracted.

Table 3.5.3 Lease Status of Federal Mineral Estate in the Planning Area

Lands	*Total Area (acres)*	*Leased (acres)*	*Unleased (acres)*
NOSR 1	34,600	4,800	31,390
NOSR 3	19,260	16,010	3,990
Non-NOSR	17,410	13,700	3,710
Total	**73,800**	**34,510**	**39,130**

Note:
Numbers do not sum precisely due to slivers of overlap and rounding.

Additional details on the BLM leasing process are included in Appendix B.

3.5.5.6 Coalbed Natural Gas

Overall, the Piceance Basin contains significant coal and gas resources in Cretaceous Mesaverde coal seams. This assessment was based on coal mapping, desorption testing, the presence of gassy mines, and production from test holes that have been drilled. The CGS report estimated that the basin contains up to 77 TCF of gas in coals. Past estimates place the subsurface coalbed natural gas resource between 53 TCF (BLM 2006).

Many factors affect coalbed natural gas production, and only a small percentage of the resource can be produced economically. The principal factors affecting production are water in the coal seams, the presence of natural fractures, the extent and continuity of the reservoir, economics, and drilling and completion technologies. The primary coal-bearing stratum (the Cameo Coal zone) is at a depth of several thousand feet in the area, making drilling costs a primary component of the economics. However, the evidence is that localized areas of high coalbed natural gas potential are present in the Piceance Basin. These areas may become profitable with sufficiently high natural gas prices and/or the application of improvements in drilling and production technologies.

3.5.5.7 Drilling and Development Approval Process

Operators are required to submit an Application for Permit to Drill (APD) to the BLM (for Federal minerals or on Federal land) to receive permission to drill. The APD comes after the NEPA process for the leasing decision (this SEIS, for example) and, if required, an EIS for a Master Development Plan. The APD must include both a drilling plan and a Surface Use Plan of Operations (SUPO). The drilling plan contains information as to the depth of the well, how it will be constructed, how groundwater and other mineral resources will be protected, and how blowouts and other emergencies will be prevented or dealt with. The SUPO covers the location and amount of surface disturbance and how that disturbance will be reduced or eliminated. The SUPO also covers mitigation of impacts to wildlife, cultural resources, vegetation, soils, surface water, and other resource values. The operator is responsible for incorporating all RMP decisions in the proposed APD.

Initially, the operator selects the location of a proposed drill site. This selection is based on COGCC spacing requirements, the subsurface geology, the topography, and the avoidance of known protected surface resource values. Spacing requirements are established by the COGCC to protect the correlative rights of offsetting mineral owners and efficiently recovering the resource. This applies to all mineral ownership (i.e., fee, State, and Federal minerals). The Roan Plateau Planning Area is subject to State spacing COGCC Rule 318, which, for wells deeper than 2,500 feet, would be about 40 acres. This does not mean that all wells can be approved at 40-acre spacing. For wells shallower than 2,500 feet, the wells

must be spaced at least 300 feet from the nearest well and a distance of at least 200 feet from the lease boundary. However, the majority of wells drilled target the Mesaverde Formation, in which 10-acre equivalency spacing is typically approved by the COGCC. This allows wells to target the equivalency of 10 acres per drilling and spacing unit so that efficient drainage of isolated tight sand lenses may take place.

BLM conducts an onsite review with the applicant to evaluate the operator's plan, to assess the situation for possible impacts (surface and subsurface), and to formulate resource protection requirements. A BLM natural resource specialist evaluates the surface plan, checking the proposal against the RMP and other guidance, conducting the onsite inspection (with other appropriate specialists), and leading the preparation of the NEPA document (usually an EA) and its associated impact analysis and proposed mitigation. When the EA is complete, there is a 30-day public comment period, after which the BLM Field Office issues a Finding of No Significant Impact (FONSI), or a decision is made that there is a significant impact and an EIS is prepared. Drilling and production operations are described in Appendix B.

3.5.6 Other Minerals

Information describing the Affected Environment for Other Minerals is carried forward from the Roan FEIS.

3.5.6.1 Oil Shale

The Parachute Creek Member of the Green River Formation is the primary oil shale-bearing unit in the Planning Area. This Member includes a continuous oil shale section that averages 120 feet thick, which contains an estimated 25 gallons of shale oil per ton (gpt) of oil shale rock. The upper part of the Parachute Creek Member contains the thickest and richest oil shale beds and would be of the most economic interest. The 2- to 6-foot-thick Mahogany Bed is a persistent layer of very rich oil shale within the Mahogany Zone, which forms a sheer cliff or ledge of rich oil shale 80 to 100 feet thick in the upper part of the Parachute Creek Member. Some oil shale also occurs in the Garden Gulch Member. Oil shale resources within the Planning Area are several miles south of thicker deposits in Rio Blanco County that range up to 1,000 feet in thickness.

The United States holds over 50 percent of the world's oil shale resources, the equivalent of 2.6 trillion barrels of oil. The oil shale resources in Colorado, Utah, and Wyoming underlie a total area of 16,000 square miles and represent the largest known concentration of hydrocarbons in the world. The Green River Formation contains an estimated 1.5 trillion barrels of oil, 72 percent of which are on public lands administered by BLM. In Colorado alone, the total resource approaches 1 trillion barrels of oil, and the Federal Government owns approximately 78 percent of the surface acreage and 82 percent of shale oil in place. In 2001, President George W. Bush established the National Energy Policy. In implementing the President's energy policy, BLM established the National Oil Shale Task Force to review, among other things, access to oil shale resources on public lands. In May 2004, the Task Force issued a report titled, Oil Shale Report for the Implementation of the President's Energy Policy.

Several energy companies (Unocal, Exxon, Mobil, etc.) investigated oil shale development in the Planning Area in the 1970s and 1980s. This included drilling programs to define the extent, thickness, and richness of the deposits, and demonstration processing (retorting) operations to assess economic feasibility. Under the technology used in the 1970s and 1980s, the cost of producing oil from shale rock was too high in comparison to producing an equivalent volume from petroleum-based crude oil. Consequently, no shale oil has been produced from the Planning Area on a sustained commercial scale.

Shell conducted an experimental oil shale operation in Rio Blanco County, northwest of the Planning Area. This method uses electric heaters lowered into boreholes to raise the rock temperature to 500 to 600 °F, thereby releasing the shale oil *in situ* (BLM 2002a). Drill-hole spacing density would be about 10 to 40 feet, and the heaters are currently capable of producing oil at depths of up to 2,000 feet. The new process has the potential to economically produce shale oil, even if the price of conventional crude oil falls below $30 per barrel. Proposals were submitted by additional energy companies for use of BLM lands to conduct research and development for various *in-situ* recovery methods. None of the research tracts are within the Planning Area or the CRVFO area.

3.5.6.2 Coal

Coal-bearing strata of potential economic interest primarily occur in Late Cretaceous rocks that overlie the Mancos Shale, particularly the Cameo Coal Zone of the Mesaverde Group. This zone has produced considerable coal and has supported a power plant farther west in Garfield County, near the downstream end of De Beque Canyon. Within the Planning Area, the cumulative thickness of coal seams is approximately 50 to 70 feet, overlain by approximately 6,000 feet of overburden at the lowest elevations of the Planning Area along I-70. Given the depth of these deposits, coal recovery within the Planning Area is not economically viable with current technologies or at current prices.

Coalbed natural gas is discussed in Section 3.5.5.6.

3.5.6.3 Other Leasable Minerals

In October 2000, American Soda, LLP, began producing soda ash and sodium bicarbonate from a nacholite (sodium bicarbonate) deposit in Rio Blanco County north of the Planning Area in the Piceance Basin. The company built a solution mine, a 44-mile pipeline, a processing plant, and a railroad spur to produce and ship its sodium products. The plant is located along Parachute Creek and CR 215, north of the town of Parachute. The facility has a designed production capacity of 900,000 tons per year of soda ash and 140,000 tons per year of sodium bicarbonate (USGS 2000).

The potential for any occurrence of recoverable sodium minerals in the Planning Area is considered negligible because the rich sodium resources to the north (i.e., those exploited by American Soda, LLP) pinch out approximately 15 miles north of the Planning Area. Nacholite is currently being mined from the Parachute Creek Member of the Green River Formation. Recoverable nacholite is interbedded with oil shale, dawsonite, halite, and other sedimentary deposits between the L5 Zone and the top of the Garden Gulch Member.

3.5.6.4 Locatable Minerals

Metallic and non-metallic hardrock minerals or other minerals regulated under the 1872 Mining Act are not known to occur within the Planning Area.

3.5.6.5 Mineral Materials

Economic deposits of sand and gravel, rip-rap, flagstone, and other types of rock materials are present in the region and may exist on a limited scale within the Planning Area. However, no commercial developments currently occur or have been designated. Any future development of these resources, if they occur, would probably be limited to lower elevations of the Planning Area (i.e., below the rim) due to proximity to markets and accessibility to highway or railroad transport. A possible exception would be if small, localized sources are developed for use in road improvements and other uses within the Planning Area as a result of increased oil and gas development.

3.5.7 Areas of Critical Environmental Concern

Information describing the Affected Environment for Areas of Critical Environmental Concern is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. Updated listing status and location data for Relevant and Important values are included, as well as Designated Critical Habitat for ESA-listed plant species.

3.5.7.1 Introduction

FLPMA directs BLM, as part of the land use planning process, to "give priority to the designation and protection of areas of critical environmental concern" (Sec. 202[c][3]). FLPMA defines ACECs as "areas within 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 or safety from natural hazards" (Sec. 103[a]). Designation as an ACEC recognizes an area as possessing relevant and important values that would be at risk without special management attention. BLM Manual 1613 outlines the procedures for nominating, evaluating, and determining if special management attention is required for potential ACECs.

BLM's process for nominating and evaluating potential ACECs involves compiling a list of areas nominated for designation and then evaluating each nominated area in terms of the ACEC relevance and importance criteria. Nominations may come from BLM staff, other governmental agencies, or members of the public. For the Roan Plateau planning process, BLM staff compiled a list of potential ACECs by reviewing resource inventories for the area, records of the CNHP, CPW species of concern, and nominations from the Colorado Wilderness Network. The complete evaluation of these areas is provided in the Roan Plateau RMP Amendment Evaluation of Proposed Areas of Critical Environmental Concern (BLM 2002c).

Potential ACECs are evaluated in the context of ACEC relevance and importance criteria. The relevance criteria arise directly from FLPMA. An area meets the relevance criteria if it contains one or more of the following:

- Significant historical, cultural, or scenic value;
- Fish and wildlife resource;
- Natural process or system; and/or
- Natural hazards.

The value, resource, system, process, or hazard described above must have substantial significance and in order to satisfy the importance criteria, generally by one or more of the following:

- Has more than locally significant qualities, especially when compared to any similar resource;
- Has qualities that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change;
- Has been recognized as warranting protection in order to satisfy national priority concerns or to carry out the mandates of FLPMA;

- Has qualities that warrant highlighting in order to satisfy public or management concerns about safety and public welfare; and/or
- Poses a significant threat to human life and safety or to property.

Following evaluation of the relevance and importance of the values found in potential ACECs, a determination is made as to whether special management is required to protect those values and, if so, to specify just what management prescriptions would provide that special management.

Ten areas were on the original list of potential Roan Plateau ACECs: Anvil Points, Magpie Gulch, East Fork Parachute Creek, Trapper/Northwater Creek, the Rifle Hogback, Ben Good Creek, Anvil Points Expansion, Parachute Creek, Schoolhouse Point, and Thirty Two Mile Gulch. Only the first four areas met the relevance and importance criteria and were included in this Draft RMPA/SEIS process. The following subsections summarize the evaluation of these four areas. A complete evaluation of all ten areas is included in the Roan Plateau RMP Amendment Evaluation of Areas of Critical Environmental Concern (BLM 2002c).

3.5.7.2 Anvil Points ACEC

The proposed Anvil Points ACEC is located along the southeastern portion of the Roan Plateau, north of Rulison (Map 13). The dominant feature in this proposed ACEC is the barren white cliff face along the southern rim of the plateau. The proposed ACEC also encompasses narrow grasslands and mesic aspen forests above the cliffs and a series of ridges and ravines at the base of the cliffs. This ACEC was expanded to include critical habitat for the Parachute penstemon. The elevation of the proposed ACEC ranges from 5,760 to 9,280 feet. Included within the eastern portion is an area of 4,320 acres classified as having lands with wilderness characteristics. The proposed designation of this area as an ACEC is based on its visual, geologic, wildlife, and botanical values.

Scenic Values

Named for the prominent Anvil Points geological features that dominate the southern cliffs of the Roan Plateau, the area includes steep, dramatic shale cliffs that give way to deep gulches, rugged ridges, and plateaus. The stark contrast of the vertical, barren shale cliffs with the vegetated slopes below gives this feature exceptional scenic quality. This dominant southeast-facing slope of the Roan Plateau is a regionally significant landscape feature and is the scenic backdrop north of the I-70 corridor between the towns of Rifle and Parachute. The qualities and character of these geologic features make Anvil Points regionally significant and vulnerable to adverse change.

Geologic Values

The southwestern portion of the proposed ACEC contains a regionally significant claystone cave that is reported to be one of the longest known caves of this type in the region. Moreover, an arch formed out of mudstone and sandstone in the Wasatch Formation is highly unusual. The cave and arch make Anvil points regionally significant, and the composition of these features makes them extremely fragile and vulnerable to adverse change.

Wildlife Values

The Roan Cliffs contain important nesting habitat for peregrine falcons and golden eagles, both of which are protected under the Federal MBTA. In addition, the golden eagle is protected under the Federal Bald and Golden Eagle Protection Act. An active peregrine eyrie and potential nesting habitat are located within the area. Several golden eagle nests are located on the cliffs that are within and adjacent to the ACEC boundary. The BLM considers this to be an important raptor nesting area and the cliffs are

identified as a wildlife security area in the 1999 FSEIS. In addition, the CNHP identified the cliffs as a Conservation Area for its plant and raptor habitat values, and Townsend's big-eared bat, a BLM sensitive species, is known to occupy the claystone cave (Section 3.3.4).

The area below the rim is important due to the diversity of vegetation types, including oakbrush and mixed mountain shrub, pinyon/juniper, sagebrush benches, and riparian habitat. These various habitat types provide essential food, cover, water, and seclusion for many wildlife species, promoting the area's high biological richness and diversity. Most importantly, the unroaded nature of the area provides security among various habitat types that is important to many wildlife species. This area provides transitional and winter range for big game and is one of the few areas where migration routes exist from the top of the Roan Cliffs to the lower slopes. The entire area faces south, which is critical to mule deer during severe winters, as these areas are free from snow. The proximity of these open, southern slopes to higher density pinyon/juniper woodland habitats is also critical as a cover component. This mosaic of habitat types and their proximity to each other also provides important nesting areas for a variety of bird species and critical birthing habitats for many other wildlife species.

This area meets the relevance criterion for wildlife resources because it contains crucial habitat for the peregrine falcon, golden eagle, and Townsend's big-eared bat. In addition, the lands below the rim contain some unroaded, unfragmented habitats, which are limited within the Planning Area. The unroaded nature of these lands provides solitude for a variety of wildlife species. This area meets the importance criterion since the wildlife values have more than locally significant qualities. The high-quality nesting habitat provided by the Roan Cliffs is regionally distinct and important for these protected bird species. In addition, the unroaded lands within the proposed ACEC are increasingly rare within the region and highly vulnerable to adverse change.

Botanical/Ecological Values

The combination of the large elevation range and the diverse geologic substrates has led to a wide variety of ecological zones and unique niches within the Anvil Points area. The CNHP has given it a biodiversity rank of B2 for "having very high significance." This proposed ACEC supports the following species and significant plant communities and provides habitat protection to sustain ecosystem processes on which they depend.

Plant Species:

- Parachute penstemon (*Penstemon debilis*): ESA threatened;
- Roan Cliffs blazingstar (*Mentzelia rhizomata*): BLM Sensitive; and
- De Beque milkvetch (*Astragalus debequaeus*): BLM Sensitive.

Significant Plant Communities (CNHP):

- Great Basin grassland (beardless bluebunch wheatgrass community);
- Great Basin montane grassland (beardless bluebunch wheatgrass/Sandberg bluegrass community);
- Aspen/Rocky Mountain maple forest; and
- Sagebrush bottomland shrubland (mountain big sagebrush/Great Basin wildrye).

This area meets the relevance criterion for botanical resources and natural processes because it contains two ESA listed threatened plant species and four significant plant communities. This area meets the importance criterion because it contains four plant species that are globally or regionally rare and four plant communities that are rare or uncommon in the United States or the State of Colorado. All of these species are vulnerable to adverse change. The Planning Area supports a significant percentage of the world's population of Parachute penstemon and Roan Cliffs blazingstar (Map 23).

Critical habitat for Parachute penstemon has been designated within and beyond the boundaries of the ACEC. The designated critical habitat includes a 1-kilometer buffer around the known plant occurrences and potential habitat in order to protect pollinators and pollinator habitat of importance for Parachute penstemon, as well as the Parachute penstemon habitat. Most of the pollinators are ground-nesting bees, which depend heavily on mat penstemon (*Penstemon caespitosus*) as well as Parachute penstemon (USFWS 2012a).

3.5.7.3 Magpie Gulch ACEC

The proposed ACEC is situated on the east- and northeast-facing slopes below the Roan Plateau (Map 15). Elevations drop from 9,200 feet at the cliff edge to 6,500 feet in the canyons below. The boundaries of the unit are virtually the same as those in the area with wilderness characteristics along the Northeast Cliffs portion of the Planning Area: the western boundary follows the eastern cliff edge of the Roan Plateau, and to the north and east it is defined by private property and an electric transmission (power line) ROW. The southern boundary is delineated by the JQS Road and private property. One 40-acre private in-holding is located in the northern portion of the proposed ACEC. Vegetation on north-facing slopes is dominated by mature to old-growth Douglas-fir, and south-facing slopes consist of mixed mountain shrub communities at the higher elevations and pinyon/juniper at lower elevations. Benches and terraces along the lower slopes support sagebrush communities.

Scenic Values

Magpie Gulch includes steep, dramatic shale cliffs that give way to deep gulches and rugged ridges at lower elevations on the eastern-most edge of the Roan Plateau. The stark contrast of the vertical barren white cliffs to the heavily vegetated slopes accentuates this unit's rugged character and exceptional scenic qualities. This unique landscape is regionally significant as it provides a scenic backdrop to the communities of Rifle, Silt, and New Castle, and to travelers along I-70 and SH 13. This area warrants special management attention because the eastern-most portion of the Roan Cliffs is not only locally important but also represents a significant visual feature on a regional scale. The qualities and character of this scenic viewshed make it sensitive or vulnerable to adverse change.

Wildlife Values

Magpie Gulch has a wide diversity of vegetation types including stringers of Douglas-fir, aspen, oak brush, mixed mountain shrub, pinyon/juniper, sagebrush benches, and limited riparian. These various habitat types provide essential food, cover, water, and seclusion for many wildlife species. For this reason, it is one of the few areas where migration routes exist from the top of the Roan Cliffs to the lower slopes. The southern aspects, supporting shrub and pinyon/juniper communities, are critical to mule deer during severe winters, as they provide areas free from snow in which mule deer can forage. The proximity of these open, southern slopes to higher density brush and tree habitats is also critical as a cover component. This mosaic of habitat types and their proximity to each other also provide important nesting areas for a variety of bird species, including wild turkey, blue grouse, and numerous migratory species, as well as critical production habitats for many other wildlife species.

Because of the diversity in vegetation and elevation, Magpie Gulch is important in maintaining a rich and diverse mix of wildlife habitats. Its unroaded nature provides seclusion among an array of habitat types important to a diverse grouping of species and is irreplaceable and exemplary in nature. This area is vulnerable to adverse changes, including habitat fragmentation and the resultant loss of species diversity.

Botanical/Ecological Values

This proposed ACEC supports several excellent examples of small, unfragmented, old-growth Douglas-fir communities, which in turn support small populations of three-toed woodpeckers (*Picoides dorsalis*). The old-growth Douglas-fir communities occur as numerous stringers and large patches (Maps 19 and 23), which together encompass approximately 1,730 acres along the north-facing slopes of the unit. CNHP has ranked it as a B-3 "highly significant" area for its biological diversity. Historic wildfires have helped create a healthy mosaic of dense and open areas important to the diverse wildlife of this area. Three-toed woodpeckers now thrive in small areas of the conifer forest inflicted with beetle infestations (Crockett and Hansley 1978).

The proposed Magpie Gulch ACEC meets the relevance criterion for natural processes, as it contains several small but excellent examples of intact, old-growth Douglas-fir communities. The area meets the importance criterion because this resource represents a remnant community type within the region; thus, it is an important site for protecting an example of this community type.

3.5.7.4 East Fork Parachute Creek ACEC

This proposed ACEC is in the headwaters of East Fork Parachute Creek, a small but biologically significant tributary to the Colorado River drainage. The headwaters for this creek begin at approximately 9,000 feet in elevation, with gently rolling hills covered with aspen forests, sagebrush and snowberry shrublands, and native grasslands. East Fork Parachute Creek originates near the eastern rim of the Roan Plateau and flows westward, cutting through the Green River Shale to form a deep canyon before plunging 200 feet into a narrow, scenic box canyon. The resource values within the proposed ACEC include this scenic waterfall and box canyon, (CRCT habitat, a BLM sensitive plant species endemic to the Green River Shale substrate, and three significant plant communities (Maps 22 and 23). Most of the proposed ACEC boundary is conterminous with the boundary of the lands with wilderness characteristics in the East Fork Parachute Creek basin.

Scenic Values

The scenic area within the proposed East Fork Parachute Creek ACEC starts about midway down East Fork Parachute Creek where a 200-foot waterfall drops into a dramatic box canyon running to the west. The viewshed consists of steep canyon walls with vertical relief of over 2,000 feet from the top of the canyon to the lowest reaches of the creek. Dramatic visual contrast is created by the narrow, incised canyon and the changes in form, line, and color. The diversity and stark contrasts resulting from the steep, barren cliffs falling off to spruce fir forests create a national park-quality scenic attraction. While this scenic portion of the Study Area is not one-of-a-kind, the region includes few other canyons of this scale and with a similar setting. East Fork Canyon was determined to be one of five high-quality (Class A) scenic areas in the 1984 GSRA RMP.

East Fork Parachute Creek meets the ACEC relevance criterion because it contains significant scenic values. It meets the ACEC importance criterion because the scenic values are irreplaceable and will benefit from special management.

Fish and Wildlife Values

This area contains year-round habitat for CRCT (Section 3.3.4). This subspecies is the only native trout in the Colorado River Basin and is designated as a special status species by the States of Colorado, Utah,

and Wyoming. In addition, the CRCT is classified as a sensitive species by Regions 2 and 4 of the USFS, and by the BLM in Colorado and Utah. CRCT were petitioned for Federal listing as threatened or endangered under the ESA on December 9, 1999.

East Fork Parachute Creek and JQS Gulch are two of five conservation populations located within the Planning Area (along with Trapper, Northwater, and East Middle Fork Parachute Creeks). The species status of the CRCT has been in a State of flux in recent years (Bestgen, Rogers, and Granger 2013; Kaeding 2003; Metcalf et al. 2007; Metcalf et al. 2012; Rogers 2010, 2012a, 2012b). East Fork Parachute Creek, East Middle Fork Parachute Creek, JQS Gulch, Northwater Creek, and Trapper Creek contain genetically pure Blue Lineage CRCT native to the White and Yampa river basins located north outside of the Planning Area. All of the occupied CRCT streams are currently recognized as containing Core Conservation populations of CRCT (i.e., CRCT that are >99 percent genetically pure or better) (Bestgen, Rogers, and Granger 2013). Despite not containing the native Green Lineage CRCT, the Blue Lineage CRCT in all of these streams are still of conservation value. The BLM and CPW are both signatories to the Range-Wide CRCT Conservation Agreement and Strategy (CRCT Conservation Team 2006, CRCT Coordination Team 2006), the primary goal of which is to ensure the long-term prosperity of native, genetically pure CRCT within their native ranges in Colorado. Despite not being the native CRCT to the area, these streams are still important in the ongoing conservation efforts for CRCT across the State.

In light of the results of the new genetic and meristic research, a need arose to determine if these Blue Lineage CRCT still meet the relevance and importance criteria for ACEC consideration. Based on a new assessment of the criteria, it was determined that the Blue Lineage CRCT, while not the native trout of the area, still meet the ACEC relevance and importance criteria. This species is currently a BLM sensitive species, which meets the relevance criterion. Because of their genetic purity, they are still an irreplaceable Core Conservation Population of CRCT, which are rarer within and outside of the range of the Blue Lineage fish. This supports the importance criterion, as does that these CRCT streams require special management attention to protect them and their habitats in the face of potential threats. It is unlikely that proposed protective measures, such as TLs, NSO, and CSU would be as extensive in the absence of these fish.

This area meets the relevance criterion for wildlife resources, as it contains a genetically pure population of native, wild, naturally reproducing CRCT that has been identified as a conservation population. The area satisfies the importance criterion since these streams are regionally and nationally important producers of native, genetically pure, and naturally reproducing CRCT.

Botanical/Ecological Values

This proposed ACEC supports the following significant plant communities and provides the habitat that sustains the ecosystem processes upon which these plants depend:

Plants:

- Hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*): formerly BLM Sensitive; and
- Roan Cliffs blazingstar (*Menzelia rhizomata*): BLM Sensitive.

Significant Plant Communities (CNHP):

- Montane riparian forest (Colorado blue spruce/red osier dogwood);
- Boxelder riparian forest (boxelder, narrowleaf cottonwood, and red osier dogwood);
- Western slope grassland (Indian ricegrass shale barrens); and

- Sullivantia Hanging Gardens (hanging garden sullivantia and oil shale columbine).

Map 23 illustrates the occupied habitat for rare plants and plant communities within the East Fork Parachute Creek watershed.

A unique wetland feature found along East Fork Parachute Creek and its tributaries is the Sullivantia Hanging Gardens community. Hanging gardens occur along seeps limited to the walls of waterfalls or cliffs. These seeps are most abundant on north-facing slopes along East Fork Parachute and Northwater Creeks, where the Green River Shale beds are exposed within the canyon walls. The hydrologic flows, combined with the Green River Shale substrate, create the unique environment that supports the hanging garden sullivantia, a Colorado endemic plant. This species is narrowly restricted to calcareous seeps and is found in abundance in these hanging gardens. Although it occurs in several locations other than the Roan Plateau, it occurs more often and more extensively in the Roan Plateau than anywhere else in the State (CNHP 1997a). Combined with occurrences in the proposed Trapper/Northwater Creek ACEC, this represents nearly 62 percent of the total known occurrences.

Roan Cliffs blazingstar, a BLM sensitive species, is an oil shale endemic species that frequently occurs with other such species. Populations of Roan Cliffs blazingstar occur on steep talus slopes below the falls on East Fork Parachute Creek.

As East Fork Parachute Creek begins to cut through the Green River Shale approximately one mile above the waterfall; here the canyon narrows and the riparian vegetation changes from willow-dominated communities to spruce/fir and narrowleaf cottonwoods. The montane riparian forest, or Colorado blue spruce/red osier dogwood plant community, is found in only a handful of riparian areas in Colorado. Below the waterfall, the riparian vegetation changes to a more low-elevation type of boxelder riparian forest or boxelder, narrowleaf cottonwood, and red osier dogwood community, which is considered rare on a global and State-wide scale.

The western slope grassland, or Indian ricegrass shale barrens community, occurs on south-facing slopes composed of shale or mudstone soils, often capped with a thin layer of gravel. This grassland community is sparsely vegetated, with often less than 25 percent vegetation cover. Indian ricegrass is the dominant species, with smaller amounts of other grasses, scattered shrubs, and forbs, including several special status plant species. This plant community is extremely limited in distribution. It occurs only in three counties in western Colorado. It is restricted to south-facing slopes with soils derived from shales or mudstones. Within the Planning Area, this community is found on south-facing slopes of East Fork Parachute Creek, Northwater Creek, Trapper Creek, and Ben Good Creek.

The proposed East Fork Parachute Creek ACEC meets the relevance criterion for natural processes, as it contains a diversity of rare or uncommon riparian plant communities and BLM sensitive plant species. The area also meets the importance criterion, since the rare plants and plant communities found in this drainage are of excellent condition and abundance and are vulnerable to adverse change.

3.5.7.5 Trapper/Northwater Creek ACEC

The proposed Trapper/Northwater Creek ACEC flows roughly parallel to East Fork Parachute Creek. Northwater Creek and Trapper Creek are smaller tributaries, with their headwaters at the eastern edge of the Roan Plateau, and flow 4 to 5 miles across the plateau before merging to form East Middle Fork Parachute Creek (Figure 1-2). The upper reaches of both Trapper and Northwater Creeks have more gentle side slopes than East Fork Parachute Creek, although all three cut the Green River Shale. The canyon walls become steeper and more abrupt just above their confluence. East Middle Fork Parachute Creek continues to cut deeper into the Green River Shale before plunging over a waterfall approximately one mile west of the public land boundary. The riparian vegetation in these three drainages is not as

diverse as that in the East Fork, although East Middle Fork Parachute Creek and the lower segment of Northwater Creek do support Sullivantia Hanging Gardens.

Fish and Wildlife Values

Like East Fork Parachute Creek, this ACEC contains year-round habitat for CRCT. This species is a relevant and important resource in the Trapper/Northwater Creek ACEC and is described in Section 3.5.7.4.

Botanical/Ecological Values

This proposed ACEC supports the following rare plants and significant plant communities and provides the habitat that sustains the ecosystem processes upon which these plants depend:

Plants:

- Hanging garden sullivantia (*Sullivantia hapemanii var. purpusii*): formerly BLM Sensitive.

Significant Plant Communities (CNHP):

- Sagebrush bottomland shrubland (western slope sagebrush shrubland community);
- Western slope grassland (Indian ricegrass shale barrens); and
- Sullivantia Hanging Gardens (hanging garden sullivantia and oil shale columbine).

East Middle Fork Parachute Creek and the lower portion of Northwater Creek contain a unique hanging gardens wetland feature with endemic sullivantia, described in Section 3.5.7.4.

The sagebrush bottomland shrubland, or Western slope sagebrush shrubland, community has only been described as occurring on the western slope of Colorado (Johnson 1987), although there is no apparent reason why this community could not be found in Utah and Wyoming, as well. On the Roan Plateau, this plant association was located on private land along a Northwater Creek tributary. Thurber fescue (*Festuca thurberi*), a component of this community, is uncommon on the Roan Cliffs. It is possible that Thurber fescue was once a more common grass on the plateau and that a century of grazing has favored sagebrush and smaller grasses over Thurber fescue. In addition, the Western slope grassland, or Indian ricegrass shale barrens community, occurs within this proposed ACEC, as described in Section 3.5.7.4.

The Trapper/Northwater Creek ACEC meets the relevance criterion for natural processes or systems because it contains the Colorado endemic hanging garden sullivantia and two uncommon plant communities: the sagebrush bottomland shrubland association and the rare Western slope grassland community. The area also meets the importance criterion since the Roan Plateau hanging gardens comprise nearly 62 percent of the total known occurrences and are, therefore, of special consequence and vulnerable to adverse change. The sagebrush/fescue site is also important because it is the only site documented within the Planning Area.

3.5.8 Lands With Wilderness Characteristics

Information describing the Affected Environment for lands with wilderness characteristics is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. Updated BLM manuals and handbooks, and management guidance, have been integrated.

3.5.8.1 Plan Conformance

Managing the wilderness resource is part of the BLM's multiple-use mission. Lands with wilderness characteristics provide a range of uses and benefits in addition to their value as settings for solitude or primitive and unconfined recreation (BLM 2012c). It is important to note this policy does not address Wilderness areas designated by Congress or Wilderness Study Areas (WSAs) pending before Congress.

The Planning Area comprises the NOSR lands, which were not under BLM jurisdiction when FLPMA was enacted and not part of the original wilderness inventory of public lands performed pursuant to Sections 201 and 603 of FLPMA. Instead, as newly acquired lands, the NOSRs fell under the general inventory and planning authority of Sections 201 and 202. These lands were inventoried for wilderness characteristics in 1999 and 2000 using procedures identified in the BLM Wilderness Inventory Handbook, September 27, 1978, and Colorado Wilderness Review Procedures, June 18, 1997. The inventory was reassessed in 2013 by the CRVFO, using methods outlined in BLM Manual 6310: Conducting Wilderness Characteristics Inventory on BLM Lands (BLM 2012b).

The inventory process entails identification of wilderness characteristics inventory units and a determination of whether the units possessed wilderness characteristics as defined by Manual 6310, listed and defined below:

1. Size – Generally, roadless units must be larger than 5,000 acres;

2. Naturalness – An area is judged to be natural if it "… generally appears to have been affected primarily by the forces of nature, with the imprint of [human activity] substantially unnoticeable." This also includes naturalness observed by the casual observer;

3. Outstanding Opportunities for Solitude and Primitive and Unconfined Recreation – An area must have outstanding opportunities for solitude or primitive and unconfined recreation; and

4. Supplemental Values – The inventory notes whether the units contain "ecological, geological, or other features of scientific, educational, scenic, or historical value."

3.5.8.2 Wilderness Characteristics Inventory

Portions of the transferred lands were inventoried in 1998 and found not to have wilderness characteristics, as documented in the 1999 FSEIS. The remaining transferred lands were inventoried by BLM in 1999 and 2000, including three inventory units: East Fork Parachute Creek, Northeast Cliffs, and Southeast Cliffs (Table 3.5.4) (Map 5, BLM 2006). In 2013, the CRVFO reassessed the results of the 1999 and 2000 inventories and found that an additional portion of the Planning Area was overlooked by the 2000 inventory (BLM 2013c). However, that area of the Planning Area was not found to contain wilderness characteristics.

Table 3.5.4 Results of Wilderness Characteristic and Roadless Inventory (acres)

Unit	*Area Inventoried*	*Roadless Area*	*Wilderness Characteristics*	*No Wilderness Characteristics*
East Fork Parachute Creek	14,330	12,460	8,330	6,000
Northeast Cliffs	5,850	5,850	5,800	50
Southeast Cliffs	5,340	5,340	5,190	150
Total	**25,520**	**23,650**	**19,320**	**6,200**

The BLM continued to receive information following the public scoping period for this project. The BLM CRVFO received new information submitted by The Wilderness Society and Conservation Colorado on December 23, 2014. After a meeting on January 22, 2015, to discuss the new information submitted, the BLM responded after a thorough review on May 18, 2015. The BLM committed to updating the wilderness characteristics inventory for the Southeast Cliff and NOSR Production Area inventory units with further fieldwork in the field season of 2015. The BLM continues to review and process the data collected. In addition, the BLM committed to fixing errors made in the Trapper Creek inventory unit, but noted that these changes would not change the end determination that the unit is not found to have wilderness characteristics.

The following subsections describe the wilderness characteristics of each of the three inventory units.

East Fork Parachute Creek Inventory Unit

This area contains 14,330 acres of Federal land, of which 8,330 acres were found to have wilderness characteristics (58 percent). This includes approximately 8.6 miles of the East Fork Parachute Creek stream corridor and 16.7 miles along eleven small tributaries. Much of the East Fork drainage appears to have been affected primarily by the forces of nature, with little evidence of human activity, such as roads and livestock developments.

The main stream has created a deep and scenic canyon. Steep topography and dense vegetation in the middle and lower portions of the drainage provide outstanding opportunities for solitude and for primitive and unconfined recreation, such as hiking, horseback riding, photography, wildlife viewing, wildflower study, camping, and sightseeing. The area is also used for hunting and fishing. Eleven separate areas representing 6,000 acres have noticeable imprints of human activity that detract from naturalness and, therefore, lack wilderness character. These imprints include roads, trails, fences, stock ponds, and spring developments. Although perhaps unnoticeable on their own, the combined effects are significant.

Several supplemental values were identified in the unit. The unit possesses high scenic values, including a 200-foot waterfall and dramatic box canyon extending to the west. The viewshed consists of steep canyon walls with vertical relief of more than 2,000 feet. Dramatic visual contrast is created by the deep, narrow canyon and changes in form, line, and color. The diversity and stark contrast of the barren cliffs abruptly changing to coniferous forest creates a scenic quality comparable to a national park. The GSRA RMP (1984) listed East Fork Parachute Creek Canyon as one of five high-quality (Class A) scenic areas in the Resource Area.

In 1996, portions of this unit were classified as a “Very Significant” conservation site by CNHP. This biologically diverse site hosts 21 elements tracked by the CNHP, including nine significant natural plant communities, four rare plant species, one rare butterfly species, one BLM sensitive fish species (the CRCT), five rare bird species, and one rare mammal species. The unit also contains cliff seeps that support one of the highest concentrations of populations of hanging garden sullivantia. Other supplemental values include fossil resources in the Green River Formation, cultural resources, such as hunting grounds for Native Americans, and ranch structures from the late 1800s.

Northeast Cliffs Inventory Unit

This unit contains 5,850 acres of Federal land, of which more than 99 percent of the unit (5,800 acres) was found to have wilderness character; the remaining 50 acres are located between an old ditch and its parallel access road in Magpie Gulch.

The Northeast Cliffs unit is long and narrow, measuring about 7 miles by 2 miles. Rugged terrain offers outstanding opportunities for solitude and primitive and unconfined recreation, although access is limited

by adjoining private land on the east and steep bluffs on the west. Only the hardiest hikers and hunters are able to enjoy the seclusion offered by the topographic screening and dense vegetation.

An important supplemental value identified in this unit is its scenic quality. Steep, dramatic shale cliffs give way to deep gulches and rugged ridges at lower elevations on the eastern edge of the Roan Plateau. The stark contrast between the vertical white cliffs and the heavily vegetated slopes below accentuates this unit's rugged character. This landscape is regionally significant because it provides a scenic backdrop to the communities of Rifle, Silt, and New Castle and to travelers along I-70 and SH 13.

Other supplemental values found at this unit include excellent examples of old-growth Douglas-fir communities, habitat for the uncommon American three-toed woodpecker, and a security area for deer and elk during the hunting season.

Southeast Cliffs Inventory Unit

This unit offers visitors outstanding opportunities for solitude and primitive and unconfined recreation, despite its narrow configuration, which measures about 6 miles long and not quite 3 miles at its widest part. The total area within the inventory boundary comprises 5,340 acres. The total area found to have wilderness characteristics includes 5,190 acres (97 percent).

Because of the unit's steep and rugged terrain, the area is undeveloped and has few human-related impacts. The few human imprints found were insignificant and do not detract from the area's overall naturalness. The diverse topography of the Southeast Cliffs includes sheer, barren 2,500-foot-high cliffs, separating gently rolling terrain on top of the plateau from the ruggedly dissected ridges below. The varied terrain provides natural screening for those hardy enough to access it.

Access is limited due to private land bounding the unit on the south and southwest, while difficult terrain restricts most visitor use in the western portion below the rim. However, once in the area, visitors have excellent opportunities to disperse and enjoy undeveloped types of recreation such as hiking, photography, wildlife viewing, wildflower study, and sightseeing. Horseback riding is possible in some parts, as well. The area is currently used for hunting.

An important supplemental value in this unit is its scenic quality. The Southeast Cliffs contain Anvil Points, a prominent rock feature that dominates the cliffs on the southern edge of the Roan Plateau and is a natural landmark along the I-70 corridor. The scenic quality of the cliffs from below is equaled or surpassed by the scenic quality of the cliffs and Colorado River valley from the upper part of the unit.

Other supplemental values include 14 elements along the Anvil Points rim that are tracked by the CNHP. One element, the Parachute penstemon, has been found in only one other location in the world. The unit also includes the Yellow Slide, which some claim to be a meteor impact site. Several oil shale endemic plants, two butterfly species, nest sites for the peregrine falcon, nesting habitat for the Columbia sharp-tailed grouse, deer and elk security areas, aesthetic and scenic qualities, and geological and paleontological values are found at this unit.

3.5.9 Streams Eligible For Designation Under The Wild and Scenic Rivers Act

Information describing the Affected Environment for streams eligible for designation under the Wild and Scenic Rivers Act is carried forward from the Roan FEIS. Tables and information have been updated to reflect revisions to Planning Area spatial data since the Roan FEIS was completed. Updated BLM manuals and handbooks, and management guidance, have been integrated.

3.5.9.1 Introduction

The Wild and Scenic Rivers Act (WSRA) of 1968 established a National Wild and Scenic Rivers System (NWSRS) for the protection of rivers with important scenic, recreational, fish and wildlife, and other Outstanding Remarkable Values (ORVs) as well as free flowing condition, water quality, and tentative classification. The Act designated 8 river segments for immediate inclusion in the system and prescribed the methods and standards by which other rivers may be added to the system.

As part of the planning process, a BLM interdisciplinary team completed a WSR study under Section 5(d)(1) of the WSRA. BLM's policy is to adhere to the requirements of the WSRA by identifying and evaluating "all rivers on BLM-administered lands that possess free-flowing condition and outstandingly remarkable values and therefore may have potential for addition to the National System." BLM will also "evaluate BLM-identified and congressionally authorized study rivers for their eligibility and suitability for WSR designation." (BLM Manual 6400). With the addition of the NOSR lands to BLM's management base, it became necessary to initiate a process that would first evaluate streams and rivers in the recently acquired lands for their eligibility as potential additions to the NWSRS and then to determine the suitability of eligible streams Inclusion in the NWSRS requires action by Congress.

The examination to determine eligibility was completed by BLM in September 2002 and detailed in the Roan Plateau Eligibility Report for the NWSRS (BLM 2002e). A suitability study has been completed and is available as the Final Wild and Scenic Rivers Suitability Report," Appendix C of the Colorado River Valley Draft Resource Management Plan (DRMP)/Draft Environmental Impact Statement (DEIS) (BLM 2014f). The suitability report is available at the following address: http://www.blm.gov/style/medialib/blm/co/field_offices/crvfo/crvfo_proposed_rmp.Par.48000.File.dat/19%20Appendix%20C%20WSR%20Study%20Report.pdf.

Suitability determinations will be made in this RMPA/SEIS. A range of alternatives are considered, from all streams deemed eligible for inclusion in the NWSRS to be considered as suitable under one alternative, not suitable under others, and remaining eligible only under one alternative. This allows analysis of a full spectrum of impact outcomes.

3.5.9.2 Eligibility Process

The WSR eligibility report was prepared by an interdisciplinary BLM team that reviewed all BLM-administered public lands along rivers and streams within the Planning Area. BLM guidance calls for evaluation of stream segments that meet the criteria of "free-flowing", having "outstandingly remarkable values" (ORVs), and tentative classification. The WSRA defines a river as any "flowing body of water or estuary, or a section, portion or tributary thereof, including rivers, streams, creeks, runs, kills, rills, and small lakes." The Roan Plateau eligibility team determined that 28 perennial streams totaling 64 miles of stream length within the Planning Area warranted evaluation. Map 16 shows those streams, but the stream segments are not labeled. These are provided in Table 3.5.5 (provided in Section 3.5.9.3) and the eligibility report. Table 3.5.5 lists the stream segments and summarizes the team's findings. A total of 24 miles of stream length were found to be eligible for WSR designation (Map 16). Of the 28 perennial stream segments evaluated, 23 were found to be free-flowing (i.e., existing or flowing without impoundment, diversion, straightening, armoring with riprap, or other modification of the waterway).

The second eligibility criterion involves the assessment of ORVs, which are river-related values that are unique, rare, or exemplary features and that are significant on a regional or national scale. The WSRA calls for evaluation of the scenic, recreation, geology, fish, wildlife, cultural, and historic values, and other similar values, when determining if the segment possesses ORVs. For the Planning Area, botanical/ecological and hydrologic values were also assessed. Only one such value needs to exist to

warrant a determination of eligibility. ORVs in the Planning Area were compared with those in the Colorado Plateau and the Southern Rocky Mountain ecoregions to evaluate regional significance.

The boundaries of any river proposed for addition to the NWSRS are usually limited to the area within 0.25 mile of the ordinary high water mark on each side of the river. Within the Planning Area, analysis was limited to this width on all river segments, except on the western portions of East Fork Parachute Creek, where the boundary was increased to encompass areas of outstanding scenic value. Once a river segment has been determined to be eligible, BLM's policy is to protect and, where possible, enhance any identified ORV, pending a subsequent suitability determination and/or designation by Congress (BLM Manual 6400). In the interim, management and authorized uses are not allowed to affect the free-flowing condition, tentative classification, or water quality necessary to support the ORVs. Boundaries may be changed once a river is found suitable.

3.5.9.3 Eligibility Findings

Of the original list of 28 streams evaluated, eight were found to have ORVs: Trapper Creek, Northwater Creek, East Middle Fork Parachute Creek, East Fork Parachute Creek, First Anvil Creek, Second Anvil Creek, Golden Castle Gulch, and JQS Gulch (Table 3.5.5). ORVs fell into three categories: scenic, fisheries, and botanical/ecological.

Table 3.5.5 Summary of Findings of WSR Eligibility Determination

Name of Stream	*Free-Flowing*	*Outstandingly Remarkable Values* [1]	*Eligible*	*Eligible Miles*
Ben Good Creek	yes	--	no	--
Bull Gulch	yes	--	no	--
Corral Gulch	yes	--	no	--
Cottonwood Creek	yes	--	no	--
East Fork Parachute Creek	yes	B, F, S	yes	8.7
East Middle Fork Parachute Creek	yes	F	yes	1.2
First Anvil Branch	no	--	no	--
First Anvil Creek	yes	B, F	yes	2.4
Forked Gulch	no	--	no	--
Golden Castle Creek	yes	B, F	yes	1.3
Goodrich Creek	yes	--	no	--
Government Creek	no	--	no	--
JQS Branch	yes	--	no	--
JQS Gulch	yes	B, F	yes	--
JV Gulch	yes	--	no	--
Northwater Creek	yes	B, F	yes	3.2
Northwater Branches	yes	--	no	--
Raspberry Creek	yes	--	no	--
Second Anvil Creek	yes	B	yes	2.0
Second Water Creek	yes	--	no	--

Table 3.5.5 Summary of Findings of WSR Eligibility Determination

Name of Stream	*Free-Flowing*	*Outstandingly Remarkable Values* [1]	*Eligible*	*Eligible Miles*
Sheep Trail Hollow Creek	no	--	no	--
Third Water Creek	yes	--	no	--
Thirty Two Mile Creek	no	--	no	--
Tichner Creek	yes	--	no	--
Timber Gulch	yes	--	no	--
Trapper Creek	yes	F	yes	6.0
West Forked Creek	yes	--	no	--
Yellow Jacket	yes	--	no	--
			Total	**24.8**

Source: BLM 2002e.

Note:
[1] ORV Definitions**:** B = Botanical/Ecological, F = Fisheries (CRCT), S = Scenic

Scenic Values

Of the 64 miles of streams and creeks analyzed within the Planning Area, only one segment, East Fork Parachute Creek west of the falls and box canyon, was found to contain scenic ORVs. This segment includes approximately 1.2 miles of East Fork Parachute Creek, starting at a waterfall and dropping into a dramatic box canyon extending to the west. The waterfall, one of the highest in Colorado, dominates the viewshed within the eastern reach of the canyon. While this scenic segment is not one of a kind, it is unusually rare and distinctive. Few canyons in the region contain a scenic feature of this scale or quality.

Fisheries Values

The value of a stream for fish may be judged on the relative merits of the fish populations, habitat, or a combination. Several streams are nationally or regionally important for sustaining native, genetically pure, and naturally reproducing populations of CRCT (Section 3.3.4).

The CRCT is the only native trout of the Colorado River Basin and has been designated as a special status species by the States of Colorado, Utah, and Wyoming. In addition, it is classified as a sensitive species by Regions 2 and 4 of the USFS and by BLM in Colorado and Utah.

Once common in most of the larger rivers of the region, including the White, Yampa, Colorado, Gunnison, and the San Juan and its tributaries, the species is now mostly limited to small headwater streams and isolated natural lakes within their historic range. As described in Section 3.3.4, the Planning Area contains five conservation populations of CRCT, defined as reproducing and recruiting populations at least 90 percent pure (i.e., with less than 10 percent genes of other species or subspecies). These populations are located in JQS Gulch, East Fork Parachute Creek, East Middle Fork Parachute Creek, Northwater Creek, and Trapper Creek. These five creeks contain 15.5 miles of habitat for the CRCT. Also, 4 miles of stream length in Trapper and Northwater Creeks contain core conservation populations, defined as having at least 99 percent genetic purity. Therefore, the Roan Plateau populations of CRCT are considered nationally and regionally significant (Hirsch et al. 2013).

In light of the new genetic and meristic research on CRCT in Colorado, as well as the need to update information for the SEIS, the BLM Interdisciplinary Team reevaluated CRCT populations and their habitats on the Roan Plateau to determine if they continue meet the criteria established in the BLM WSR Manual 6400 for an ORV (BLM 2012d). After a review of the new information, the BLM interdisciplinary team concluded that the Blue Lineage CRCT found on the Roan Plateau is a BLM sensitive species that meets the Relevance criterion. Because of its genetic purity, it is still an irreplaceable Conservation Population of CRCT, which is rare within and outside the range of the Blue Lineage fish. In addition, the occupied streams require special management attention to protect the fish and their habitats in the face of potential threats. These facts support the Importance criterion.

Botanical/Ecological Values

Seven of the 28 streams evaluated as WSRs in the Planning Area support rare plants or significant plant communities. East Fork Parachute Creek supports several species and plant communities considered rare or imperiled in Colorado, including the Southwest stickleaf, a BLM sensitive plant. East Fork Parachute Creek and its tributaries (JQS Gulch, Golden Castle Creek, First Anvil Creek, and Second Anvil Creek, as well as East Middle Fork Parachute Creek and lower Northwater Creek) contain hanging garden environments that support the narrowly endemic hanging garden sullivantia. Nearly two-thirds (62 percent) of the known populations of this species occur in the Planning Area (Section 3.3.3). The occurrences of rare or imperiled plant communities and hanging garden associations in these drainages are outstandingly remarkable or nationally/regionally significant when compared with other areas in the ecoregion.

3.5.9.4 Stream Classification

The process of determining eligibility for designation as a WSR also includes a preliminary classification into one of three categories: wild rivers, scenic rivers, or recreational rivers. This classification is based on the type and degree of human development on adjacent lands at the time of the evaluation. See the WSR eligibility report (BLM 2002e) for a complete description.

Wild Rivers

Wild rivers are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These rivers represent vestiges of primitive America. All or portions of seven of the eight eligible streams within the Planning Area were found to be wild in character: East Fork Parachute Creek, First Anvil Creek, Second Anvil Creek, Golden Castle Gulch, Trapper Creek, Northwater Creek, and East Middle Fork Parachute Creek (Map 16).

Scenic Rivers

These rivers are free of impoundments, with banks and watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. “Scenic” does not necessarily mean the river corridor has scenery as an ORV, but that it may contain more development than a wild segment and less development than a recreational segment. All or portions of five of the eight eligible streams have a preliminary classification of scenic: East Fork Parachute Creek, First Anvil Creek, Second Anvil Creek, JQS Gulch, and Trapper Creek (Map 16).

Recreational Rivers

Recreational river areas may be readily accessible by road or railroad, may have some development along their banks, and may have undergone some impoundment or diversion in the past. Existing small dams and diversions may be allowed, as may the presence of parallel roads or railroads. Recreational rivers are not necessarily managed for recreational use. Portions of Second Anvil Creek and Trapper Creek were preliminarily classified as recreational rivers (Map 16).

3.5.9.5 Water Quality

BLM has reviewed the water quality associated with the streams found eligible by the interdisciplinary team in 2002 and determined that under existing conditions there are no water quality issues that are likely to impair or degrade the ORVs.

3.5.10 Forest Products

Information describing the Affected Environment for Forest Products is carried forward from the Roan FEIS.

3.5.10.1 Management Plans and Documents

The forest management objective in the 1984 GSRA RMP, which included the Planning Area, is to "manage all suitable commercial forest land and woodland to meet sawtimber and fuelwood demand and maintain stand productivity."

The forest management objectives in the 1997 WRRA RMP are to "(1) determine the sustainable, annual allowable timberland harvest level on suitable commercial and non-commercial timberlands; (2) manage all timberlands to maintain productivity, extent, [and] forest structure, and for the enhancement of other resources; and (3) provide special management consideration for special or unique forest/woodland areas."

The woodlands objectives in the 1997 WRRA RMP are to "(1) determine annual allowable woodland harvest level on suitable/commercial woodlands; (2) determine allowable use levels on non-commercial woodlands; and (3) manage all woodlands to maintain productivity, extent, [and] forest structure and for the enhancement of other resources."

The forest management objective outlined in the DOE OMP (OMP) for NOSRs 1 and 3 (DOE 1988) is as follows: "NOSR timber resources shall be managed to prevent deterioration of the soils and vegetation and the visual resources of the NOSRs and shall be consistent with good fire pre-suppression techniques."

3.5.10.2 Current Management

The Priorities of Implementation section of the 1984 GSRA RMP indicates that forest management plans were to be prepared on the two remaining forest management units (Castle Peak and the NOSRs). Measures were taken in the mid-1980s to draft a forest management plan for the NOSRs. Discussions between BLM and DOE during the 1980s and early 1990s were focused on funding to actively manage the forest on the NOSRs. Despite various meetings and requests for funding, monies were never allocated for forest management. Instead, DOE funding was focused on fire protection and livestock grazing management. A timber sale prospectus was developed in 1990 for the potential harvest of various stands of aspen. However, lack of funds to carry manpower costs of a sale precluded this action.

Historical files in the GSFO detail tree-planting efforts in Golden Castle Gulch, with the objective of establishing ponderosa pine, white fir, and Douglas-fir during the late 1960s. Discussions with former BLM employees indicate that a contract was issued and planting occurred. Field review of the site in 2000 found no evidence of introduced planting stock or tree establishment.

In summary, few records are available that indicate active or even passive forest management in the Planning Area. A USFS forest management plan written in the mid-1960s recommended an intensive tree-planting program with the objective of establishing ponderosa pine. A sale of Douglas-fir saw logs occurred in 1983 with access from a private road off Piceance Creek (Section 28, T4S, R94W). A public area for cutting of juniper fuelwood has been open for permit since the early 1990s on 32 Mile Mesa off

SH 13, about 6 miles north of Rifle. No records of forest product sales or projects from the WRRA area are available.

3.5.10.3 Resource Condition and Capabilities Evaluation

The aspen resource of the Planning Area can be found in varying stages of growth, with many stands in overall decline, as evidenced by signs of rot and breakdown. Consequently, merchantability of many stands is questionable. Most of the aspen stands in the Planning Area appear to be self-sustaining, although gradual succession to coniferous forest is indicated by the presence of conifer seedlings in the understory of some sites. Conifer forests of the Planning Area are generally multi-aged and self-sustaining.

In general, the forest resource on the Planning Area is in over-mature condition with expanding signs of decay and mortality. Fir aphids have been recognized as a pest problem since the late 1970s. Decline of subalpine fir and aspen and mortality from Douglas-fir beetle were identified in USFS aerial monitoring of the plateau in 1996 (BLM 2002a). Pockets of fir and aspen decline were identified in the headwaters of Northwater and Trapper Creeks. Douglas-fir mortality was noted on the steep slopes along the eastern rim and Ben Good Creek. No reference to these occurrences was made in Forest Insect and Disease Conditions in the Rocky Mountain Region (Harris et al. 2002). This document included results of the USFS 2001 aerial monitoring.

Timber harvest potential exists within the Planning Area, although optimum yield most likely passed 15 to 30 years ago. The better aspen sites where conifer establishment is occurring in the understory would be “choice” stands for management if maintenance of aspen were a management objective. Most conifer sites, being multi-aged in structure, possess marginal yield capacity and high percentages of low-valued subalpine fir. Very few spruce trees are found on the plateau and, to preserve species diversity, should not be targeted for harvest. The highest and best use for most forested stands is riparian protection, wildlife cover/habitat, and soil protection/stabilization. Pinyon/juniper woodland below the rim offers limited potential for fuelwood harvest, primarily because of rough topography and lack of public access.

3.5.11 Fire Management

Information describing the Affected Environment for fire management is carried forward from the Roan FEIS. Updated BLM management guidance is incorporated.

3.5.11.1 Management Plans and Documents

The fire management objectives outlined in the OMP for NOSRs 1 and 3 (DOE 1988) have been replaced by updated Fire Management Plans (FMPs) for the CRVFO and WRFO. The FMPs were completed to comply with the 1995 Federal Wildland Fire Management Policy and the 2001 Review and Update of the 1995 Federal Wildland Fire Management Policy (BLM 2002f). The policy directs BLM field offices to have an approved FMP for every area with burnable vegetation.

Fire Management Zones (FMZs) define differing strategies for managing and prioritizing wildland fires and prescribing vegetation treatments for fuel hazard reduction and resource benefit. Table 3.5.6 summarizes the FMZs in the Planning Area.

Table 3.5.6 Fire Management Overview

FMZ	Description	Wildfire Management		Vegetation Treatments		
		Suppression Priority	Suppression Strategy	Wildland Fire Managed for Resource Benefit [1]	Prescribed Fire Use	Mechanical, Biological, Chemical, Manual Use
B	Unplanned wildland fire, not desired	High	Aggressive	No	Yes, fuel hazard reduction to mitigate risks a priority.	Yes, fuel hazard reduction to mitigate risks a priority.
C	Wildland fire desired but must consider significant constraints	Moderate	Appropriate responses	No	Yes, fuel hazard reduction lower priority than "A" or "B." Used to attain desirable conditions.	Yes, fuel hazard reduction lower priority than "A" or "B." Used to attain desirable conditions.
D	Wildland fire desired, with few constraints	Low	Appropriate responses	Yes, under prescribed conditions	Yes, used to attain desirable resource conditions. Fuel hazard reduction is lower priority than "C."	Yes, used to attain desirable resource conditions. Fuel hazard reduction is lower priority than "C."

Sources: BLM 2001a,f.

Note:
[1] Use of wildland fires to accomplish specific, stated resource management goals in predefined geographic areas.

The 1984 Glenwood Springs Resource Area RMP was amended in September 2002 by EA No. CO-140-2001-0051 (BLM 2002d) to incorporate fire management direction. Site-specific NEPA review is prepared for each vegetation treatment. The amended GSRA RMP and FMP document the goals, objectives, fire management direction, suppression direction, and guidance for prescribed fires for the GSRA.

The White River Resource Area completed an EA (EA No. CO-017-WR-99-99-EA; BLM 1999) in 1999 to integrate fire management with resource management programs within the WRRA. That EA identified the appropriate management response for all natural unplanned ignitions within the WRRA. The fire management objective for the WRFO portion of the Planning Area, as described in the 1997 WRRA RMP, is to "manage (using appropriate management response) naturally ignited fires throughout the unit to promote a vegetation mosaic [and to] conduct prescribed burns or other vegetation treatments on mountain shrub and sagebrush types to achieve age and structural diversity."

3.5.11.2 Evaluation of Resource Condition and Capabilities

Natural historical ("pre-settlement") conditions exist in few areas today. The influences of human activities and land uses such as livestock grazing, water development, road construction, recreation, the intentional or inadvertent introduction of exotic plant species, and more than a century of fire suppression have altered the composition of the plant communities and their response to fire.

In many areas, prolonged fire suppression has created conditions of high fuel loading at the ground surface. Fires in these areas may be hotter and more destructive than under natural conditions. In extreme cases, these fires can "sterilize" the soil by destroying the soil seed bank, surficial organic matter, and soil organisms. These hotter fires can also kill trees that would survive a lower intensity fire. The development of "ladder fuels" in the form of dense shrubs or small trees in the understory can also lead to the

destruction of a forest by spreading the fire from the ground, where it is less threatening, up to the tree crowns. These crown fires can then spread rapidly and violently through the forest canopy. Returning these areas to a cycle of periodic, low-intensity fires may require prescriptive vegetation treatments to reduce shrub and tree density. The Planning Area includes areas of invasive, non-native species, such as cheatgrass, musk and other thistles, houndstongue, and tamarisk that are adapted to shorter fire intervals than native species. Since these species have both higher survival and more rapid reestablishment (by re-sprouting or by germination from seeds) following fire, they often increase in dominance compared to the native component. Consequently, reestablishment of a beneficial and self-sustaining plant community in areas that have burned is important to the ecological and visual quality post-fire habitats.

3.5.11.3 Current Fire Management

Public lands are managed under four FMZ classifications for the purposes of wildland fire and prescribed vegetation management. Only three FMZ classes occur within the Planning Area (FMZ classes B through D) (Table 3.5.6). FMZs are based on BLM Instruction Memorandum No. 2002-034 (BLM 2001e) and Clarification of Fire Management Categories and RMP-Level Decisions in BLM Handbook H-1601-1 BLM 2001a).

A full range of wildland fire management options, from full suppression to use of unplanned ignitions managed for resource benefits, are applied by BLM. This allows the use of naturally caused, unplanned wildfires to be managed for multiple objectives, including resource benefit in specific geographic areas. Fire is also managed under a suppression strategy using fuels treatments to meet FRCC objectives, to protect and conserve sage grouse habitat, improve land health, address wildland-urban interface issues, and achieve natural resource objectives.

Atop the Plateau

The top of the Roan Plateau is currently managed as FMZ C and D (Map 32). If predetermined criteria are met, fires may be managed under a resource benefit strategy to achieve desired objectives such as improving vegetation, wildlife habitat, or watershed conditions. Wildland fires under a suppression strategy are managed using the appropriate management response commensurate with predetermined constraints (negative effects to values and zone goals). Wildland fires under a suppression strategy are contained within natural or man-made barriers/firebreaks. Areas in FMZ D have the lowest priority for suppression in a multiple fire situation.

No more than 50 percent of the FMZ D area atop the plateau should burn over a 10-year period. Wildland fire suppression guidelines apply for CRCT, northern leopard frog, and Parachute penstemon along the Anvil Points rim. Wildland fire suppression restrictions also apply to areas with commercial wood product designation.

Northeast Cliffs and Southeast Cliffs

The cliffs along the northeastern and southeastern margins of the plateau are currently managed as FMZ C (Map 32). The FMP for the Field Office acknowledges that fire is a desirable component of the ecosystem. However, constraints must be considered, including private lands and homes, topography, archaeological and historical sites, visual aesthetics, wilderness characteristics, rare plants, the old-growth Douglas-fir community, big game security areas, and habitat for a variety of other sensitive species. Wildland fires are managed using the appropriate management response commensurate with predetermined constraints. Management strategies are intended to ensure that wildland fire is contained within natural or man-made barriers/firebreaks. FMZ C areas have a lower suppression priority in multiple wildland fire situations than FMZs A or B. No more than 50 percent of the FMZ C areas should

burn over a 10-year period. Wildland fire suppression guidelines apply for northern leopard frogs, and suppression restrictions apply to commercial wood product areas.

Lower Elevations along the I-70 Corridor

The lower elevation terrain below the rim is currently managed as FMZ B (Map 32). The GSFO FMP recognizes that fire plays a natural role in the function of the ecosystem. However, an unplanned ignition in these lands could have negative effects unless or until some form of mitigation takes place. All wildland fires in FMZ B, regardless of ignition source, are a high priority and receive prompt suppression action commensurate with human safety in all instances. Fire suppression is usually aggressive to minimize wildland fire size. Wildland fire suppression guidelines apply for bald eagle winter range, ESA listed Colorado River fishes, Great Basin spadefoot toads, and northern leopard frogs. Wildland fire suppression restrictions for commercial wood product areas and ACECs also apply. Managers emphasize prevention/mitigation programs that reduce unplanned ignitions and threats to life, property, and natural and cultural resources.

3.5.12 Public Health and Safety

Information describing the Affected Environment for Public Health and Safety is carried forward from the Roan FEIS. Data and Information have been updated to reflect new data sources and revisions to Planning Area spatial data since the Roan FEIS was completed. Updated information on oil and gas well drilling technologies, including hydraulic fracturing, is also incorporated.

In addition to preserving and protecting natural and cultural resources, BLM's stewardship role extends to protecting public health, safety, and property (BLM 2014d). Public health and safety is primarily discussed in terms of activities with the potential to create risk to, or degrade, health and safety. Public health and safety is affected by various factors, such as sites containing dangerous materials or situations, and enforcement of laws, regulations, and guidelines designed to protect the public.

Management of activities in the Planning Area should take into account potential risks to public health and safety. Of particular concern to the Planning Area are the potential impacts on human health and safety from the continually expanding exploration and development of fluid mineral resources. This includes hydraulic fracturing to enhance recovery of natural gas and associated liquid hydrocarbons and emissions to the atmosphere of natural gas (methane) and other gaseous constituents.

Hydraulic fracturing has been used for more than 70 years to enhance the recovery of oil and gas hydrocarbons from bedrock by creating small fractures that function as preferential flowpaths of fluids toward the borehole. Recent advances in hydraulic fracturing technology have opened to development huge reserves of domestic natural gas that previously could not be extracted from the rock. This advance has been primarily realized in "tight" formations, particularly deep marine shales and marlstones that have very low permeability due to very small grain size, in addition to the pressure from thousands of feet of overlying strata.

In Garfield County, approximately 14 percent of oil and gas wells access Federal mineral estate under permits from the BLM, while approximately 86 percent of the wells access private minerals under the purview of the COGCC. The BLM requires oil and gas operators to comply with applicable regulations designed to protect the environment and the public, as well as additional requirements imposed by the BLM, as part of the drilling permit, lease, or ROW grant.

3.5.12.1 Water Quality

Public concern about the use of hydraulic fracturing has been focused on the potential for contamination of freshwater aquifers and impacts to domestic and municipal water supplies. An associated concern has involved the potential for earthquakes caused by the creation of enough pressure within the formation to cause fractures. Potential risks associated with the use of hydraulic fracturing are addressed in Section 4.2.4, Water Resources, and Section 4.5.5, Oil and Gas.

In 2011, the COGCC published an analysis of hydraulic fracturing technology use in the State and potential risks to human health and the environment. The introduction to that report included the following paragraph at page 8, which holds true as of the date of this document:

> "Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing."

In addition to public concerns about the use of hydraulic fracturing is heightened public concern about contamination of freshwater aquifers and water wells, surface waters that serve as municipal water supplies, and, more generally, contamination related to oil and gas development. A non-peer-reviewed "white paper" addressed the chemicals used or produced during oil and gas development, but made little reference to health or environmental statistics (Witter et al. 2008). However, the authors did note two situations relative to environmental exposures. One was the reported occurrence of detectable levels of methane in 135 of 184 water wells, springs, seeps, ponds, and rivers sampled during a hydrogeologic (groundwater) investigation conducted for Garfield County in 2006 (S.S. Papadopoulos & Associates, Inc. 2007). That study noted that methane may have been present due to natural levels in some of the bedrock formations penetrated by the water wells or recharging the seeps, springs, and surface water, and that it may also be generated by a natural (bacterial) process within the water wells. Because the study could not identify the sources of methane, Witter et al. were unable to conclude whether the methane in the wells and natural waterbodies sampled during the investigation resulted from oil and gas related activities or from a secondary generation of methane by natural bacterial processes unrelated to oil and gas (Witter et al. 2008).

The USGS published a detailed assessment of methane in water wells in the Silt-Rifle area of the Planning Area, within which a large portion of oil and gas development has occurred and where, due to more concentrated human populations, the number of water wells is relatively high (McMahon, Thomas, and Hunt 2011). The study, which used various geochemical analyses to evaluate the likely origins of methane in water wells, documented methane higher than trace concentrations in four of the 27 wells. Trace concentrations are common in waters derived from the Wasatch Formation, the surficial and shallow bedrock formation within which most of the non-alluvial water wells in the Planning Area are completed. The four wells were located along a belt of anoxic (low-oxygen) groundwater in the Wasatch Formation, indicating a biogenic source from natural bacterial processes and not indicating methane from the gas-producing Mesaverde Formation or associated with oil and gas wells. One sample did contain methane with a geochemical signature, indicating a thermogenic (deep) origin from the Mesaverde Formation, the primary hydrocarbon-producing formation in the Planning Area. However, that sample also contained biogenic methane, indicating that it had moved through the Wasatch Formation while migrating toward the water well. This indicates movement along a natural fracture system along the axis of the Rifle-Grand Hogback Syncline. Fractures commonly form along the axes of synclines (downwarped folds) and anticlines (upward folds) due to compressional and tensional forces, respectively. However, the authors also concluded that the methane migrating to that water well was unrelated to oil and gas activities.

In addition to the potential for groundwater contamination, Witter et al. (2008) also discussed a documented occurrence of benzene and other organic compounds in surface water at seeps along West Divide Creek within the Planning Area (URS 2006). That occurrence was related to insufficient use by one oil and gas operator of surface casing and cement to isolate shallow groundwater from the bore of a private (non-BLM-administered) well and led to the enactment of more stringent requirements by COGCC, also adopted by the BLM. The operator was fined, and the penalty money was used to help fund the hydrogeologic investigation cited above (S.S. Papadopoulos & Associates, Inc. 2007). The COGCC also determined that migration of the methane to the seeps was not the result of hydraulic fracturing of the problematic oil and gas well (COGCC 2010).

Measures currently required by the BLM and COGCC for protecting groundwater aquifers, water wells, and surface waters (streams, springs, and seeps) are described in Section 3.2.4 of the Colorado River Valley Proposed RMP/FEIS (BLM 2014a). These measures include isolating deeper, hydrocarbon-producing horizons from shallower bedrock and alluvial layers that communicate with surface waters and within which freshwater wells are completed in the Planning Area. Examples include requiring setting casing to a depth below the deepest freshwater aquifer encountered and the water wells in the vicinity, and cementing the casing to prevent the flow of saline waters, natural gas, and associated fluids that move up the borehole from contacting the freshwater zones. In general, the CRVFO requires surface casing at depths of 800 to 1,000 feet, roughly twice the depth of the deepest water wells in the area. In specific areas, however, the COGCC and CRVFO may require surface casing to greater depths where indicated by the local geology in relation to surface waters or shallow aquifers.

3.5.12.2 Air Quality

Chemicals produced during oil and gas operations mostly consist of natural gas (methane) and produced water (a saltwater brine, the remnant of the ancient seas in which the deposits were laid), with a small amount of associated liquid constituents that are separated from the gas and produced water at the surface. Among the constituents of natural gas condensate are volatile organic compounds (VOCs), such as benzene, toluene, ethylbenzene, and xylenes (BTEX). Active oil and gas wells can release atmospheric pollutants due to:

- Uncaptured gases produced from the wellbore;
- Emissions from condensate tanks, separators, vehicle exhausts, pipeline compressor engines, and open pits containing hydrocarbon fluids; and
- Fugitive dust from access roads and other disturbed surfaces.

Abandoned wells may continue to be a source of pollutant emissions if not properly plugged and capped.

As a result of the increased health concerns among residents of Garfield County, the Board of County Commissioners commissioned studies intended to characterize potential exposures to oil and gas related pollutants via air and water pathways. One non-peer-reviewed study used hypothetical emission and exposure scenarios to calculate potential risks from emissions of natural gas and associated VOCs, including the known carcinogen, benzene (Coons and Walker 2008). For example, the study's calculations indicated that EPA's acceptable lifetime (70-year) cancer risk at distances extending approximately 500 meters (1,650 feet) downwind from an uncontrolled well with all of its natural gas production released directly to the atmosphere. By assuming a 93 percent capture rate, the authors estimated that EPA's acceptable 70-year exposure risk for a 70-year duration would be exceeded only within 75 meters of the well bore (246 feet) downwind from a well with uncontrolled emissions. During normal operations, however, the actual recovery rate of natural gas and associated benzene has generally been reported by the oil and gas industry in the Planning Area as greater than 99 percent, including the

capture and use of natural gas onsite to power equipment. During flowback between completion of a well and full use of production equipment, natural gas is required to be ignited and consumed ("flaring"), a process that also destroys associated VOCs (called "green completions").

Some recent reports indicate much higher emission rates for methane from oil and gas fields. However, those results have been questioned for several reasons, including measurements being taken during drilling (when releases are greater, but transitory compared to long-term production) and individual sources indicating some operational upset or equipment failure. A summary and assessment of the recent findings is available online (Revkin 2014).

Coons and Walker (2008) also assumed uncontrolled releases of vapors from hydrocarbon fluids stored on a well pad at 20 tons of VOCs per year. However, the COGCC requires emission controls on all sources exceeding 5 tons per year. Because their hypothetical exposures used atypically high emission rates, a 70-year exposure duration (compared to the 30-year life of most wells), and a location very close to a well pad and constantly downwind from the pad, the potential health consequences reported by Coons and Walker (2008) are substantial overestimates compared to reasonable scenarios for the public.

Coons and Walker (2008) also addressed reported illness rates among residents of Garfield County for a variety of afflictions, with data for Garfield county generally within or below the reported illness rates for three other counties (Mesa, Delta, and Montrose) with much lower levels of oil and gas development. In comparing cancer rates in Garfield County to Colorado as a whole, Coons and Walker (2008) found a significantly higher rate of all cancers combined in the county than statewide for males from 1992 through 2000 and for females from 1992 through 1998. However, these periods pre-dated the rapid expansion of oil and gas development that began in the early 2000s. In contrast, cancer risks in the Garfield County were no higher than statewide rates for the period from 2001 through 2005, which included the initial expansion of oil and gas. The authors cautioned that cancer has a lag time from exposure to expression and that additional monitoring is needed. However, the assumptions used in their study (no or very low recovery of produced natural gas and associated compounds and a 70-year exposure duration in proximity to a well pad always upwind from the receptor) do not reflect likely exposures to the public.

Acknowledging the limitations of their study, the conclusion by Coons and Walker (2008) included the following statement: "There is no health crisis in Garfield County, but there are some health trends that should be monitored. We cannot say conclusively that any of these health trends are directly related to the presence of natural gas industry activities or other factors." Similarly, as noted by several comment letters received by the BLM following public review of the Colorado River Valley Draft RMP/Draft EIS, the authors were quoted in the Glenwood Springs Post Independent newspaper as saying that "…there is not a 'health crisis' because of rapid natural gas development in the county. (Yates 2008)"

Another non-peer-reviewed human health risk study was conducted for Garfield County (Witter et al. 2008). Funded by the environmental community, this study concluded that "human health risks and social impacts are associated with oil and gas development." Witter et al. (2008) based this conclusion largely on the types of chemicals used in, or produced by, oil and gas activities and not on documented release rates of those chemicals to the environment and exposure to the public. Thus, this study cataloged potential risks associated with uncontrolled exposures, at unspecified exposure rates, and for unspecified exposure durations. In summarizing the results of the Coons and Walker (2008) report, Witter et al. (2008) cited a higher combined cancer rate among Garfield County residents compared to statewide statistics, but did not mention that the trend was true only in the 1990s, as noted in the paragraph above, and did not extend into the period from 2001 through 2005, during which oil and gas production expanded. The truncation of the trend in the early 2000s may have been related to the influx of new residents associated with the expansion of oil and gas development, possibly changing population

demographics in terms of age or other factors related to cancer rates. The authors also noted that Garfield County has higher rates than statewide rates for chronic obstructive pulmonary disease, asthma, and low birth weight, the first two of which are higher in Colorado than in the rest of the nation, despite a lower rate of tobacco use and a relatively young and fit population. The authors made no speculation as to the possible contributors to these trends. However, the fact that the majority of county and statewide residents are in urban areas instead of rural areas in proximity to oil and gas drilling and production suggests that the higher incidences of chronic obstructive pulmonary disease, asthma, and low birth weight are related to some other factor or combination of factors.

A more recent study of natural gas operations from a public health perspective (Colborn et al. 2011) noted the following:

- Toxic chemicals are used during both the drilling and fracturing phases of gas operations;
- Long-term health effects may not be immediately recognized; and
- Waste evaporation pits may contain numerous chemicals on EPA's Superfund list.

The study's findings cited the difficulty of developing monitoring programs. To protect public health, the study recommended full disclosure of the contents of all products, extensive air and water monitoring, a comprehensive human health study, and regulation of hydraulic fracturing under the SDWA (Colborn et al. 2011).

In Colorado, the COGCC requires operators to maintain a list of the chemicals used in the hydraulic fracture of each well and to submit that information to an online data repository (fracfocus.org). Table 3.5.7 presents a typical list of chemicals used in hydraulic fracturing of tight gas formations, such as the Mesaverde in the Planning Area.

Table 3.5.7 Constituents of Typical Hydraulic Fracturing Operation in Tight Gas Formations

Additive Type	*Typical Example 1*	*% by Volume 2*	*Function*	*Common Use of Example Compound*
Acid	Hydrochloric acid	0.123	Dissolves mineral cement in rocks and initiates cracks	Swimming pool chemical and cleaner
Biocide	Glutaraldehyde	0.001	Eliminates bacteria in the water that produce corrosive or poisonous by-products	Disinfectant; sterilizer for medical and dental equipment
Breaker	Ammonium persulfate	0.010	Allows delayed breakdown of the gel	Used in hair coloring, as a disinfectant, and in manufacture of household plastics
Clay stabilizer	Potassium chloride	0.060	Creates a brine carrier fluid that prohibits fluid interaction with formation clays	Used in low-sodium table salt substitutes, medicines, and IV fluids
Corrosion inhibitor	Formic acid	0.002	Prevents corrosion of the well casing	Used as preservative in livestock feed; used as lime remover in toilet bowl cleaners
Crosslinker	Borate salts	0.007	Maintains fluid viscosity as temperature increases	Used in laundry detergents, hand soaps, and cosmetics
Friction reducer	Polyacrylamide	0.088	"Slicks" the water to minimize friction	Used as a flocculant in water treatment and manufacture of paper

Table 3.5.7 Constituents of Typical Hydraulic Fracturing Operation in Tight Gas Formations

Additive Type	*Typical Example 1*	*% by Volume 2*	*Function*	*Common Use of Example Compound*
Gelling agent	Guar gum	0.056	Thickens the water to help suspend the sand propping agent	Used as a thickener, binder, or stabilizer in foods
Iron control	Citric acid	0.004	Prevents precipitation of metal oxides	Used as flavoring agent or preservative in foods
Surfactant	Lauryl sulfate	0.085	Increases the viscosity of the fluid	Used in soaps, shampoos, detergents, and as foaming agents
pH adjusting agent	Sodium hydroxide, acetic acid	0.011	Adjusts pH of fluid to maintain the effectiveness of other components	Sodium hydroxide used in soaps, drain cleaners; acetic acid used as chemical reagent, main ingredient of vinegar
Scale inhibitor	Sodium polycarboxylate	0.043	Prevents scale deposits in the pipe	Used in dishwashing liquids and other cleaners
Winterizing agent	Ethanol, isopropyl alcohol, methanol	--	Added as necessary as stabilizer, drier, and anti-freezing agent	Various cosmetic, medicinal, and industrial uses
	Total Additives	**0.49**		
	Total Water and Sand	**99.51**		

Sources:
[1] FracFocus 2014.
[2] DOE 2009.

Also in 2010, a study by the CDPHE on behalf of the Garfield County Public Health Department used data collected from four monitoring sites located in proximity to oil and gas developments, of which two were in a rural area and two were in a more urban area (CDPHE 2010). This report was an extension of a previous study, the results of which were first reported in 2007 (CDPHE 2007). For cancer risks, the study concluded that "the estimated cancer risks associated with the six [contaminants of potential concern] are not likely to result in significant health impacts." For non-cancer (chronic and acute) health hazards, the study concluded that "overall, significant non-cancer health effects are not likely to occur." However, this does not mean that health risks from living in proximity to oil and gas activities do not exist. For example, the cancer risk calculations showed a low to moderate potential increase (1.1 to 1.7 additional cancers per 10,000 residents during a 70-year exposure duration). For non-cancer health risks, the "hazard quotient" (HQ) rating ranged from 0.4 to 0.9, with values less than HQ = 1 indicating no "appreciable" health impacts. The study did not compare data for the four sites analyzed to air concentrations in locations remote from oil and gas activities in the county or elsewhere in the State.

McKenzie et al. (2012) used monitoring data collected by the Garfield County Public Health Department from a fixed station "in the midst of rural home sites and ranches and [natural gas development] during both well development and production" as well as "grab samples" collected from the perimeters of four well pads, at distances of 130 to 500 feet from the well pad center. The data were extrapolated to include five years of well development (construction, drilling, and completion) at a pad, followed by 20 to 30 years of production and maintenance activities (30 years total duration). Although the report shows higher risks within 0.5 mile of an oil and gas well pad, none of the risks were significantly elevated for either cancer or non-cancer health effects for any modeled receptors. In addition, a development period of five years at a given pad is much longer than the typical period of a few months to a year.

Colborn et al. (2011) reported on potential health risks of atmospheric emissions from a single multi-well pad across a period of 15 months before, during, and following drilling of 16 oil and gas wells, including hydraulic fracturing. Pre-drilling background data were collected from July through September. The sampling site was described as a rural residence located 0.7 mile from the well pad, located near Battlement Mesa in the western part of the Planning Area. The authors reported "no correlation between detected emissions…and wind direction" and inferred that atmospheric inversions may explain why concentrations were higher during winter and with calm winds. Indeed, with one exception, concentrations were much lower outside the period from mid-December through mid-January, despite drilling operations from late October through late March. Data presented did not include concentrations during baseline sampling prior to activities at the pad. The authors did not assert that measured concentrations represented an acute or chronic health risk, but they did express concern about the concentrations of polycyclic aromatic hydrocarbons (PAHs) in relation to mental development of children exposed prenatally (before birth). That concern was based on studies in New York City and Poland in which pregnant women carried personal air monitors. The authors noted the difficulty in comparing results of studies using personal monitors to those with stationary samplers.

Early in 2014, McKenzie et al. (including some of the same co-authors from the 2012 paper) reported on a comparison of birth outcomes (including birth defects) in relation to residential proximity of the mothers to oil and gas operations in rural Colorado counties. Outcomes addressed included congenital heart defects (CHDs) and neural tube defects (NTDs), such as spina bifida, as well as oral clefts, preterm births, and term low birth weight. The study assessed a total of 124,842 births in Garfield County during the period from 1996 to 2009. Data were grouped by relative proximity of the mother's residence to a natural gas well (less than 10 miles versus more than 10 miles). The intensity of development within 10 miles was classified as low, medium, and high. Data were compiled from public birth records. Other variables included ethnicity (White Hispanic/White Non-Hispanic), gender of the infant, maternal use/non-use of tobacco, maternal education, the number of times the mother had given birth, elevation of the residence, and straight-line distance from the nearest natural gas well. The results of the study, when adjusted for the other variables, showed a 30 percent greater occurrence of CHDs (173 vs. 133 per 10,000) for the group in the highest one-third in terms of wells within 10 miles of the residence. For NTDs, the number in the same group was twice as great (8.4 vs. 4.2 per 10,000), although the data were adjusted only for residence elevation because of the small number of total incidents (i.e., not adjusted for ethnicity, tobacco use, alcohol use, etc.). Interestingly, the rate of NTDs was lower in the low- and medium-intensity development groups compared to mothers residing more than 10 miles from a well. Also interestingly, oral clefts, preterm birth, and low birth weight occurred slightly less frequently for mothers residing less than 10 miles from a well, highlighting the role of other variables and the difficulty of analysis with small sample sizes.

McKenzie et al. (2014) cited earlier studies in Texas and Sweden in which exposure to benzene correlated with a frequency of NTDs. The study also cited positive correlations between elevated exposure to components of engine exhaust and CHD and NTD birth defects (in China and California). Limitations of the study included:

- The inability to address other variables potentially associated with birth defects;
- The lack of an exposure pathway that resulted in elevated ambient concentrations of benzene or other potential teratogenic (birth-defect-causing) agents causally linked to oil and gas activities at the distances used; and
- The lack of more extensive information on familial and medical history of the mothers.

Because of these limitations, the authors concluded that the results are only suggestive of a possible link and, therefore, warrant further investigation. In a news release on February 9, 2014 (coloradoan.com), the Chief Medical Officer for CDPHE highlighted the study's limitations, concluding that "Many factors known to contribute to birth defects were ignored" and that "people should not rush to judgment."

Based on the studies cited above, it is clear that some chemicals emitted to the atmosphere during oil and gas development have the potential for health effects with certain types, levels, and durations of exposure. However, emitted concentrations diffuse rapidly with increasing distance from the well pad, and exposures to members of the public are of much shorter duration and at much lower concentrations than those associated with chronic health effects. The recent statewide study of birth defects in relation to oil and gas activity, as cited above, has similar limitations of not being causally linked to exposure to one or more specific pollutants at demonstrably elevated levels or related to oil and gas. Consequently, no actual, existing health effects from oil and gas activities in western Garfield County have been documented. However, increasing levels of oil and gas development in combination with the increasing human population in the county, as well as the results of likely future studies, could lead to a different conclusion. For the present, the BLM and COGCC ensure adherence to State and Federal health-related standards and guidelines during oil and gas exploration and development, and apply mitigation measures intended to minimize exposures to potentially harmful compounds. Future tightening of health-based standards by State and Federal agencies would be applied and enforced for future projects through COAs and through the BLM's and COGCC's regulatory authority.

3.5.12.3 Hazardous Wastes and Materials

Wastes associated with oil and gas exploration and production are exempt from regulation under RCRA Subtitle C (hazardous materials), but are regulated under RCRA Subtitle D (solid waste) and State regulations. The RCRA Subtitle C exemption applies to, among other things, produced water, constituents removed from produced water prior to injection or disposal of the spent water, drilling fluids, drill cuttings, rig wash, pit sludges, tank bottoms (sludge) from storage facilities, gas plant dehydration wastes, workover wastes, produced sand, packing fluids, stimulating fluids, and hydrocarbon-bearing soil. This exemption does not apply to listed waste solvents, painting wastes, unused fracturing fluids or acids, used lubricating oils, waste compressor oil and filters, pigging wastes from gathering lines, caustic or acid cleaners, sanitary wastes, pesticide wastes, and radioactive tracer wastes. Additionally, any hazardous substances, as listed or defined under CERCLA, that are contained within one of the exempted wastes and released into the environment are regulated under CERCLA. For example, produced water is exempt under RCRA Subtitle C, but any CERCLA hazardous substances within the water are regulated under CERCLA if they are released into the environment.

Oil and gas wells are primarily drilled with rotary drilling rigs. In the rotary method, drilling mud is used as a lubricant for the drill bit and to lift well cuttings to the surface. At the surface, the drilling mud is diverted to tanks or pits for cleaning and treatment. Water requirements for drilling a well in the Wasatch or Mesaverde Formations range from 5,000 to 15,000 gallons per day (approximately 159 to 476 barrels per day). This water is delivered to the site by truck. Operators in the region typically reuse water from the drilling mud to reduce transportation costs. Drilling mud typically contains several additives to enhance the properties of the fluid, including:

- Weighting materials, primarily barium sulfate, to increase the density of the mud;
- Corrosion inhibitors, to protect metal components from corrosion;
- Dispersants, to break up solid clusters of clay particles;
- Flocculants, to cause suspended particles to group together so they can be removed by settling;

- Surfactants, such as fatty acids and soaps, to defoam and emulsify the mud;
- Biocides, to kill bacteria that may inhabit the mud and clog the formation; and
- Fluid loss reducers, including starch and polymers, to limit the loss of drilling fluid to subsurface formations.

Typical drilling mud reported by WPX Energy Rocky Mountain LLC (WPX) as being used in the Planning Area includes additives such as barite, sawdust, caustic soda, soda ash, bentonite, lignite, aluminum stearate, bicarbonate of soda, cottonseed hulls, lime, potassium chloride, sodium polyacrylate, an organic thinner, and a liquid polymer (EZ-Mud). These materials fall within the broad category of well completion, treatment, and stimulation fluids that are exempt under RCRA Subtitle C.

Drill cuttings, consisting of rock debris mixed with some residual drilling mud, are typically not removed from the site. Approximately 100 cubic yards of cuttings are typically generated for each well drilled in the Planning Area. The cuttings are buried in pits 8 to 10 feet deep within the drill pad area, backfilled with soil and subsoil stripped and stockpiled during excavation, and revegetated. The pits are generally unlined.

Produced Water

WPX, the largest oil and gas developer in the Planning Area, had 740 gas wells in the Roan Plateau region as of January 2003. Each well generally yields four barrels of produced water per day, for a total of approximately 3,000 barrels per day. About 60 percent of this water is used for finishing wells, where the water is filtered, chlorinated, and injected to fracture the formation or for other purposes. The remaining water is evaporated in evaporation pond facilities (Cesark 2003). WPX does not use onsite pits for evaporation but, instead, trucks the produced water offsite. None of these wells and associated surface facilities are located on or were drilled into the Federal oil and gas leases issued pursuant to the Roan Plateau RMPA/FEIS.

The produced water contains about 10 percent natural gas condensate, a light hydrocarbon that is sold to produce gasoline and reported as “oil” to the COGCC. Produced water ranges in salinity from about 7,000 to 26,000 parts per million (ppm) of total dissolved solids (TDS), with an average salinity of about 20,000 ppm. Most of this salinity consists of sodium and chloride ions (i.e., NaCl, common table salt).

Information on the chemistry of the produced water was obtained from data reported to CDPHE from the Black Mountain brine disposal facility in De Beque, Colorado. This facility receives fracturing waters and drilling fluids in addition to produced waters. The water in Pond 1, the first evaporation pond at the Black Mountain facility, was analyzed periodically from 1990 through 2002. Black Mountain facility is now operated by Greenleaf Environmental Services, which is replacing solar evaporation of produced waters and other aqueous fluids with treatment and recycling. They also use advanced biological and chemical treatment technologies for drilling fluids (drilling mud). These processes greatly reduce emissions of VOCs to the atmosphere compared to the previous evaporation pond method. Comparisons of average concentrations of pond water reported by Black Mountain with CDPHE water quality standards are provided in Table 3.5.8. The water quality standards shown include secondary (non-health-based) and primary (health-based) drinking water standards (maximum contaminant levels [MCLs]), agricultural (livestock watering/irrigation) stream standards, and aquatic life (coldwater fisheries [trout]) standards). Coldwater fisheries standards in the table are the most stringent value applicable to any of various segments in the East Fork Parachute Creek watershed. Calculated standards used a hardness of 25.

All of the analyte concentrations presented in the table are conservative (i.e., more likely to be overestimates than underestimates) in relation to actual produced waters at the well sites because of

concentration associated with evaporation. Also, the chemistry of water at the Black Mountain facility is likely to differ somewhat from the chemistry of produced waters from the Planning Area, since the facility also receives other types of fluids. However, most of their throughput is from regional wells. Note that exceedances (average concentrations that exceed a standard) include the secondary (non-health-based) drinking water standards for calcium, iron, bicarbonate, and chloride; agricultural stream standards for copper and zinc; and aquatic life (coldwater fisheries) standards for cadmium, iron, manganese, and chloride. The most important exceedance is for chloride, reflecting the high salinity of the produced waters. The other exceedances are relatively slight and could be the result of evapoconcentration in the disposal pond. This underscores the importance of keeping produced water from reaching area streams in significant quantities, especially for the small streams atop the plateau in which seasonal flows can be very low and insufficient to achieve the nearly 50-fold dilution required to bring the chloride concentration to within the aquatic life standard.

Table 3.5.8 Chemistry (mg/L) of Produced/Disposed Waters at the Black Mountain Disposal Site Evaporation Pond, De Beque, Garfield County, Colorado [1]

Analyte	*Average Value of Analytes in Pond Waters 1990 – 2002*	*MCLs [2]*	*Stream Standards for Agriculture [3]*	*Aquatic Life Standards [4]*	*Groundwater Standards for Agriculture [5]*
Arsenic	<0.001	0.05	0.1	0.05	0.1
Barium	0.28	2.0	--	--	--
Cadmium	0.02	0.005	0.0008	0.01	0.01
Copper	0.4	1.0	0.0027	0.2	0.2
Iron	7.5	0.3	1.0	1.0	5.0
Lead	0.003	0.05	0.014	0.1	0.1
Manganese	0.96	0.05	1.04	0.2	0.2
Mercury	<0.0002	0.002	0.00001	.00077	0.01
Zinc	0.07	5.0	0.036	2.0	2.0
Sodium	6,941	250	--	0.2	--
Calcium	564.8	500	--	--	--
Chloride	11,816	250	--	250	--
Bicarbonate	1,470	250	--	--	--
Carbonate	<0.5	250	--	--	--
Sulfate	63.6	250	--	--	--
Total Alkalinity	1,129.2	500	--	--	--
Total Dissolved Solids	23,000	500	--	--	variable
pH	7.20	--	6.5-9.0	6.5-9.0	6.5-8.5

Notes:
1 Specific water quality standards vary depending on designated water use and location.
2 MCLs = maximum contaminant levels. Colorado and/or EPA secondary (non-health-based) drinking water standards (the 500 ppm standard is for total hardness).
3 Stream standards are Colorado agricultural water standards. Values were calculated using a hardness of 25.
4 Coldwater aquatic life standards are lowest value for various designated stream segments of East Fork Parachute Creek watershed.
5 Colorado State groundwater standards for agricultural uses.

Hydrogen Sulfide Emissions

At this time, the only known hydrogen sulfide within the boundaries of the Planning Area is associated with produced water within the well bore. This results from the introduction of bacteria during workover or completion activities. Mitigation for this situation is being accomplished by injecting biocides to reduce the bacterial action producing the hydrogen sulfide. Additionally, the gas streams are being tested for hydrogen sulfide during normal sampling periods.

Transport of Natural Gas, Condensate, and Produced Water

Oil and gas operators are responsible for understanding and abiding by all applicable hazardous materials transportation laws and regulations. The potential exists for pipelines carrying natural gas, liquid condensate, or produced water to develop leaks or ruptures during natural gas extraction, transport, and processing. Data available online from the U.S. Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA), in Colorado for all pipelines, indicated that significant incidents occurred at the rate of approximately 0.03 per every 480 miles of pipeline (48,000 miles total) (USDOT PHMSA2014). Significant incidents are defined by PHMSA as including any of the following conditions: Fatality or injury requiring in-patient hospitalization; $50,000 or more in total costs, measured in 1984 dollars; highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; and/or liquid releases resulting in an unintentional fire or explosion. For gas gathering pipelines, such as those that comprise most of the lines in the Planning Area, no significant incidents occurred during the 10-year period across the 732 miles of pipelines statewide. Including gas transmission lines, one significant incident occurred during the 10-year period across 7,848 miles of pipelines statewide.

Nationwide, more than 50 percent of pipeline ruptures occur as a result of heavy equipment striking the pipeline. Such ruptures would potentially cause a fire or explosion if a spark or open flame ignited the natural gas escaping from the pipeline. Pipeline design, materials, maintenance, and abandonment procedures are required to meet the standards set forth in USDOT regulations (49 Code of Federal Regulations [CFR] 192, Transportation of Natural Gas by Pipelines). In the Planning Area, oil and gas operators are required to maintain and implement a Spill Prevention, Control, and Countermeasures (SPCC) plan, including such cleanup and mitigation measures as required by the BLM or the State.

Spills and Releases

BLM has stipulated procedures to be followed in the event of a spill or release from an oil and gas production facility on BLM land (BLM 1999b). These procedures require that the BLM be notified in the event of “all spills or leakages of oil, gas, produced water, toxic liquids or waste materials, blowouts, fires, personal injuries, and fatalities.” The operator is to report any such releases to the BLM and the Surface Managing Agency immediately for all “Class 1” events (more than 100 barrels of fluid or 500 MCF [or “thousand cubic feet”] of gas) (BLM 1999b). Therefore, if more than 100 barrels of produced water were released into the environment, the operator would be required to notify the BLM and initiate corrective actions.

BLM will use its delegated authority under CERCLA to respond to uncontrolled releases of hazardous substances on Federal lands, or on private lands with oil and gas produced from a Federal mineral estate. Response actions will be in accordance with the procedures and requirements of the National Contingency Plan (NCP) set forth in 40 CFR 300. Exemptions to CERCLA hazardous substances can be found in Section 101(4) of the Act. The only exceptions to CERCLA are crude oil, natural gas liquids, liquefied natural gas, or synthetic gas. Thus, all other substances listed as a hazardous substance that are released to the environment are subject to CERCLA, including those from oil and gas operations.

The Colorado Oil and Public Safety Division regulates oil and gasoline in the State and requires that responsible parties report any release of more than 25 gallons of a regulated substance within 24 hours. State regulations, contained at Colorado Code of Regulations (CCR) 8-20.5 Section 101 (Oil and Public Safety), define crude oil and natural gas condensates as regulated substances subject to these reporting requirements, but tanks associated with oil and gas production facilities are exempted. Relevant excerpts from CCR 8-20.5 Section 101 include the following:

> (13) "Regulated substance" means: (a) Any substance defined in section 101 (14) of CERCLA but not including any substance regulated as a hazardous waste under Subtitle (C) of RCRA; or (b) Petroleum, including crude oil, and any fraction thereof that is liquid at standard conditions of temperature and pressure (60F and 14.7 pounds per square inch absolute).
>
> (14) "Release" means any spilling, leaking, emitting, discharging, escaping, leaching, or disposing of a regulated substance from an underground storage tank into groundwater, surface water, or subsurface soils.
>
> (15) "Reportable quantities" means quantities of a released regulated substance which equal or exceed the reportable quantity under CERCLA, and petroleum products in quantities of 25 gallons or more.
>
> (b) "Above-ground storage tank" does not include:
>
> (I) A wastewater treatment tank system that is part of a wastewater treatment facility.
>
> (II) Equipment or machinery that contains regulated substances for operational purposes.
>
> (III) Farm and residential tanks.
>
> (IV) Above-ground storage tanks located at natural gas pipeline facilities that are regulated under State or Federal natural gas pipeline acts.
>
> (V) Above-ground storage tanks associated with natural gas liquids separation, gathering, and production.
>
> (VI) Above-ground storage tanks associated with crude oil production, storage, and gathering.
>
> (VII) Above-ground storage tanks at transportation-related facilities regulated by the Federal Department of Transportation.
>
> (VIII) Above-ground storage tanks used to store heating oil for consumptive use on the premises where stored.
>
> (IX) Above-ground storage tanks used to store flammable and combustible liquids at mining facilities and construction and earthmoving projects, including gravel pits, quarries, and borrow pits where, in the opinion of the director of the division of oil and public safety, tight control by the owner or contractor and isolation from other structures make it unnecessary to meet the requirements of this article.
>
> (X) Any other above-ground tank excluded by regulation.

Potential regulated releases could be from tanker trucks, onsite tanks, or evaporation ponds. The average condensate tanks at the wellheads are typically 300 barrels per wellhead, and produced water tanks are generally between 200 and 300 barrels per wellhead. Transport trucks range in capacity from 60 to 120 barrels. Produced water typically contains about 10 percent condensate. Therefore, tankers and ponds can contain more than 25 gallons of natural gas condensate at any given time. As stated above, the BLM requires reporting of brine releases that exceed 100 barrels.

3.5.12.4 Contaminated Sites

A search of several pertinent environmental agency records was conducted for the properties within one mile of the Planning Area. Because the Planning Area has historically been the focus of extensive resource exploration projects, undocumented sources of environmental contamination that pre-date modern environmental regulations are likely.

CERCLA/Superfund Sites

A search of EPA's CERCLA Information System (CERCLIS) database, dated January 2003, indicated no CERCLA sites within 1 mile of the Planning Area.

CERCLA/RCRA/Hazardous Waste Notifiers

The RCRA Notifiers List is an inventory of transporters, burner/blenders, and large-, small-, and very small-quantity generators of hazardous wastes. None occur on Federal lands in the Planning Area. Large-quantity generators generate more than 1,000 kilograms (2,205 pounds) of hazardous waste per month. Small-quantity generators generate between 100 and 1,000 kilograms (2,205 pounds) per month. Conditionally exempt small-quantity generators (very small) generate less than 100 kilograms (220 pounds) per month. No large-quantity generators were found in the RCRA Information System (RCRIS) database within 0.5 mile, and no other facilities were located within 0.25 mile. Table 3.5.9 lists the small-quantity generators and conditionally exempt small-quantity generators within one mile of the Planning Area. Note that the Unocal shale oil facility is also listed as a treatment, storage, and disposal facility.

Table 3.5.9 CERCLA/RCRA/Hazardous Waste Notifiers Within One Mile of the Planning Area

Facility	*Address/Location*	*Status*	*ID*
American Soda LLP	2717 CR 215, Parachute	Not Classified	COR000016014
Anvil Points Oil Shale Facility	8 miles W of Rifle on I-70	Removed	CO9890031876
CDOT – Rifle	SH 13 at milepost 2	Conditionally Exempt Small-Quantity Generator	COD983771791
Development Eng. Inc.	1354 CR 246, Rifle	Conditionally Exempt Small-Quantity Generator	CO0890090129
Exxon Co USA	16 miles N of Parachute, CR 215	Conditionally Exempt Small-Quantity Generator	COD000651539
JQS Trail, Rifle	NW¼, SE¼, Sec. 2, T5S, R93W	Not Classified	COR000005249
KN Energy Inc.	1879 CR 264, Rifle	Small-Quantity Generator	COR00007179
Occidental Oil Shale Inc.	20011 CR 5	Not Classified	COD000716530
Rifle Clough Compressor	Sec. 13, T6S, R93W	Conditionally Exempt Small-Quantity Generator	COD981550064
Rifle Gas Plant	620 CR 264	Conditionally Exempt Small-Quantity Generator	COR000000125

Table 3.5.9 CERCLA/RCRA/Hazardous Waste Notifiers Within One Mile of the Planning Area

Facility	*Address/Location*	*Status*	*ID*
Rulison Compressor	Sec. 21, T6S, R93W	Conditionally Exempt Small-Quantity Generator	COD981550080
Unocal Shale Oil Facility	10735 CR 215, Parachute	Conditionally Exempt Small-Quantity Generator, Treatment, Storage, and Disposal Facility	COD980718902

Anvil Points Oil Shale Facility

The Removal Action at the Anvil Points Facility (APF) was implemented as specified in the Non-time Critical Action Memorandum (Action Memo) dated January 20, 2006. The Action Memo documented the basis for the BLM decision to conduct a non-time critical removal action in response to releases and threatened releases of hazardous substances at the APF. This action was taken pursuant to the BLM's lead agency authority under Section 104(a) of CERCLA, 42 U.S.C. 9604, and Section 300.415 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. The APF is currently listed as an archived site in the EPA CERCLA Information System (CERCLIS). The CERCLIS ID number is CO9890031876. The archive designation means that assessment has been completed and EPA has determined that no steps will be taken to designate the APF as a priority by listing it on the National Priorities List (NPL).

The selection and implementation of the preferred alternative is documented in the CERCLA Action Memo and was based upon the Engineering Evaluation and Cost Analysis (EE/CA), dated May 2005 (E & E 2005a), and the Site Inspection (SI) Report, dated June 2005 (E & E 2005b). The EE/CA summarized sampling and testing information from previous studies, and proposed and evaluated alternatives for removal actions that would be protective of human health and the environment.

The Action Memo states that one of the principle components of excavation, relocation, and placement of the retorted shale material would be the "implementation of structural and non-structural Best Management Practices to manage movement of materials during excavation, hauling, and placement in the final repository." Thus, BLM's CERCLA non-time critical removal actions at the APF were completed in three main phases. Each of the three Phases went through an extensive design review process performed by BLM and the CDPHE. This design review was implemented to ensure that the objectives outlined in the EE/CA were captured in the proposed construction documents. All final construction documents were signed and sealed by professional engineers registered in the State of Colorado.

Phase I was the initial construction phase and consisted of the following activities: waste shale pile removal, shale pond excavation and backfill, placement of shale waste material into an on-site repository, hauling and disposal of shale waste and impoundment material, removal of contaminated soil from various locations throughout the site, decontamination and demolition of existing structures, improvements to the adits and associated infrastructure, remediation of the revegetation plots, and maintenance and documentation. Phase I actions were completed in 2009.

Phase II, which was completed in 2010, included construction of a second repository in conjunction with the removal and placement of additional shale material from the waste shale pile. The Phase II repository was constructed directly south and adjacent to the Phase I repository.

Phase III included the construction of the third repository in conjunction with the removal and placement of the last remaining waste shale pile material. The Phase III repository is located approximately one mile southwest of the Phase I and II repositories. Phase III activities were completed in 2012.

A ROW was issued by BLM with clearly defined boundary lines that encompass all three repositories. The ROWs were recorded in the official land records of the United States and establish a prior existing authorization that prevents any future use that could interfere with the stated purpose of the ROWs. The ROWs were issued in perpetuity.

Environmental Covenants

Landowners and CDPHE have been given the authority to impose environmental covenants that limit access or use of a property due to ongoing contamination and/or remediation projects. No environmental covenants restrict public lands within the Planning Area; however, the Old Rifle Mill site, located in portions of Sections 15 and 18, Township 6 South, Range 93 West, is located within the Planning Area vicinity, but entirely on private property. Use restrictions for the environmental covenant are as follows:

- No habitable structure may be constructed on the property without properly designed radon mitigation as approved by the DOE;
- Wells completed in the alluvial aquifer or the Entrada Formation may not be used for domestic or potable water supplies;
- No tilling, excavation, grading, construction, or any other activity that disturbs the ground surface is permitted on the property, without the express written consent of the DOE; and
- No activities that will in any way damage any monitoring or remedial wells installed by the DOE or interfere with the maintenance, operation, or monitoring of the wells are allowed without the express written consent of the U.S. Department of the Interior (USDI) and the DOE.

3.5.12.5 Worker Health and Safety

In terms of worker health and safety, Witter et al. (2008) presented data indicating that the rate of illness, injury, and fatality among oil and gas workers in Garfield County is higher than in most job sectors. Looking at their data in detail shows that fatality rates among oil and gas workers are approximately the same as for agricultural workers and that illness and injury rates are lower than for both agricultural and construction workers. Witter et al. (2008) also reported that “rapid industrial change” can have deleterious impacts on the psychosocial welfare of the local population in terms of increased crime and drug use, but added that “further study is needed to determine if industrial development, in the form of oil and gas drilling, is contributing [to an increase in these rates] in Garfield County.” To date, no further study has been conducted.

3.5.13 Renewable Energy

Information describing the Affected Environment for renewable energy is carried forward from the Roan FEIS.

In February 2003, BLM and the National Renewable Energy Laboratory (NREL) issued a report identifying public lands most suitable for increased development of renewable energy (DOE and BLM 2003). The report examined Federal areas, including those administered by BLM in 11 western states, for the highest energy potential from four renewable sources: wind, solar, geothermal, and biomass. The assessment was undertaken in response to the National Energy Plan. BLM and DOE worked with

industry experts to develop screening criteria for each type of energy. Factors considered included geography, infrastructure requirements, access to roads and power transmission lines, and proximity to towns and cities. Findings of the assessment indicated that the region including the Planning Area was not among the 25 highest rated areas for any of these potential energy sources.

Since publication of the Roan FEIS, renewable energy resources have gained public interest and importance. Solar and wind facilities for generating electricity have increased in number in response to this growing public interest, driven in large part by concerns regarding global climate change, and particularly in response to government mandates and advances in technology.

3.5.13.1 Wind Power

A maximum potential development scenario was created by BLM lands in 11 western states (DOE and BLM 2003). The BLM and NREL developed screening criteria for areas of wind power potential. This study concluded wind power development on top of the Roan Plateau would most likely not be feasible.

3.5.13.2 Solar Power

In 2012, the BLM and DOE completed the Final Solar Energy Development Programmatic EIS (BLM and DOE 2012) that evaluated potential areas for utility-scale (projects generating electricity capacities greater than 20 megawatts) solar energy development in Arizona, California, Colorado, Nevada, New Mexico, and Utah. Based on these criteria and analysis, four solar energy zones (SEZs) were proposed in Colorado; however, these SEZs are not within the Planning Area. Therefore, the potential for solar development in the Planning Area is unlikely.

3.5.13.3 Geothermal

Due to the presence of warm springs in the CRVFO area, approximately 254 square miles have been identified as having potential for geothermal energy development, though high-potential geothermal sites were identified without developing screening criteria (DOE and BLM 2003). None of these areas were identified within the Planning Area; therefore, geothermal development in the Planning Area is not likely.

3.5.13.4 Biomass

Plants, plant-derived materials, crop waste, food waste, and organic matter from municipal and industrial wastes can all be utilized to produce biomass power. Biomass can be used for direct heating (burning wood in wood stove) and for generating electricity, or it can be converted directly into liquid fuels to meet transportation energy needs (biodiesel for buses) (BLM 2011).

The BLM evaluated the potential for biomass energy using the Normalized Difference Vegetation Index (NDVI) computed from the National Aeronautics and Space Administration's (NASA's) Advanced Very High Resolution Radiometer Land Pathfinder satellite program (DOE and BLM 2003). No such areas occur within the Planning Area. Therefore, it is unlikely that biomass production would be a feasible energy development option on top of the Roan Plateau.

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