3.0 Affected Environment

This chapter describes the condition of the human and natural environment in the GNBPA (**Figure 1.1-1**). For NEPA, the human environment is the natural and physical environment and the relationship of people to that environment. The affected environment for individual resources was delineated based on the area of potential direct and indirect environmental impacts for the proposed project and the associated cumulative effects area. For many resources, the resulting study area includes the proposed GNBPA. Other resources (e.g., watersheds, air quality, transportation network) are addressed in a larger regional context.

The environmental baseline information summarized in this chapter was obtained from review of published sources, unpublished data, communications with government agencies, and review of field studies of the area. The level of information provided in this chapter is commensurate with the potential impacts to the resource described.

3.1 Air Quality

The study area for air quality is the Uinta Basin. Air quality within the GNBPA has the potential to be affected by such activities as emissions from the construction and operation of oil and gas facilities, access roads, and other elements of management activities. Regional air quality also is affected by natural events such as windstorms and wildfires. These natural events generally are short lived, lasting from several hours to perhaps several days. The effects during these events may be impact human health and the environment, and generally are considered part of the natural and physical environment. This section describes the existing air quality resource of the region and the applicable air regulations that would apply to the Proposed Action and alternatives.

3.1.1 Regional Climate

The climate in the region is characterized as arid, with cold winters and hot summers. Annual precipitation (rainfall and snowfall) in the region ranges from 8 to 10 inches. A climate summary for Vernal, Utah, is presented in **Table 3.1-1**.

Table 3.1-1 Monthly Climate Summary for Vernal Airport, Utah

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Max. Temp. (degrees Fahrenheit [°F])	29.7	37.5	50.6	62.4	72.7	82.4	89.8	87.3	78.0	64.3	46.5	33.2	61.2
Avg. Min. Temp. (°F)	4.9	10.9	22.1	30.5	38.6	45.6	51.7	49.9	41.2	31.2	19.5	9.3	29.6
Avg. Total Precip. (inches)	0.49	0.48	0.66	0.82	0.83	0.71	0.52	0.71	0.85	1.09	0.57	0.57	8.30
Avg. Total Snow Fall (inches)	4.8	2.9	1.6	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.9	4.7	15.4
Avg. Snow Depth (inches)	1	1	0	0	0	0	0	0	0	0	0	0	0

Note: Period of Record: 1/1/1928 to 6/30/2007.

Source: Western Region Climate Center 2007a.

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, stability, and wind (speed and direction). Mixing height is the height above ground within which the air is well mixed due to wind-induced turbulence or buoyancy from surface heating. A relatively high mixing height allows the surface-level pollutants to be mixed into a deeper layer, thereby diluting the concentration and reducing the ambient air quality impact from those emissions. Mixing heights vary by several factors: 1) time of day due to the influence of the sun's heating of the surface inducing buoyant mixing within that layer and the cooling at night; 2) terrain features that may inhibit flow; 3) cloud cover that inhibits daily heating and cooling; 4) turbulence from winds in relation the roughness of the surface; and 5) the passage of weather systems and large-scale convection that act to mix air vigorously. In the GNBPA, average morning mixing heights are approximately 1,000 feet and annual mean afternoon mixing heights are more than 7,800 feet (Holzworth 1972). Mean morning mixing heights tend to be lowest in the summer and fall, and highest in the spring months.

Atmospheric stability patterns are related to the temperature change with height above the surface and also are affected by surface winds. If the temperature decreases rapidly with height, the atmosphere tends to be unstable and the pollutants are well mixed. If the temperature increases with height (a temperature inversion), the atmosphere is stable and it inhibits the dispersion of pollutants. As related to the mixing heights, the atmosphere is more stable in afternoon hours due to solar heating, and tends to be more stable late at night and early morning due to surface cooling. The atmosphere generally is most stable on clear, cold, winter mornings with calm winds and on days with snow cover at the surface. In and around the GNBPA, the typically dry atmosphere leads to increased instability in the afternoons with extended periods

of sunshine, and the dry conditions lead to stable conditions in the early morning because of the clear skies and strong night-time surface cooling. Stable conditions also develop along lower lying terrain features, such as valleys, due to the sinking of colder air into those valleys, with warmer air aloft. Thus, the topography plays a role in development of localized atmospheric stability conditions.

The dispersion of pollutants also is related to local wind speeds and changing wind direction. Dispersion is enhanced by higher wind speeds that simply dilute the emitted pollutants. Dispersion also is enhanced by wind flow that changes direction in short periods of time or changes direction at various levels above the surface layers. The GNBPA lies within the prevailing westerly wind belt, and within that belt, the associated large-scale storm systems that pass through the area act to enhance dispersion of pollutants.

Air pollutant dispersion in the area also is dependent on wind direction and speed. Although wind direction is highly influenced by the local terrain, the wind direction at Vernal tends to be westerly, (i.e., blowing from the west). **Figure 3.1-1** presents a wind rose for the Uinta Basin region depicting the frequency of wind speeds and direction.

3.1.2 Air Quality

Air quality in a given location is defined by pollutant concentrations in the atmosphere and is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The existing air quality in the proposed development area is considered to be acceptable for human health and the environment since it is in attainment of the NAAQS and State AAQS (SAAQS) or has insufficient data to establish compliance. Representative ambient background levels of pollutants measured in Uintah and Salt Lake counties in Utah, and Sweetwater County, Wyoming, are shown in **Table 3.1-2**. Data for this table were obtained from the Utah Division of Air Quality (UDAQ) Air Monitoring Network data archives website. The carbon monoxide (CO) data from Salt Lake County are not representative of the area, but were used to provide a conservative estimate of background levels for estimating impacts on the NAAQS for CO.

Table 3.1-2 Ambient Air Quality Background Values

Pollutant	Averaging Period	Ranking[1]	Year	Concentration ($\mu g/m^3$)	County	State
Nitrogen dioxide (NO_2)	Annual	H	2006	13.2	Sweetwater	Wyoming
		H	2007	13.2	Sweetwater	Wyoming
CO	1-hour	H2H	2004	6,210	Salt Lake	Utah
		H2H	2005	6,325	Salt Lake	Utah
		H2H	2006	6,325	Salt Lake	Utah
	8-hour	H2H	2004	3,680	Salt Lake	Utah
		H2H	2005	3,910	Salt Lake	Utah
		H2H	2006	3,450	Salt Lake	Utah
Sulfur dioxide (SO_2)	3-hour	H2H	2006	18.3	Sweetwater	Wyoming
		H2H	2007	15.7	Sweetwater	Wyoming
	24-hour	H2H	2006	10.5	Sweetwater	Wyoming
		H2H	2007	5.2	Sweetwater	Wyoming
	Annual	H	2006	2.6	Sweetwater	Wyoming
		H	2007	2.6	Sweetwater	Wyoming
Particulate matter (PM) with an aerodynamic diameter of 10 microns or less (PM_{10})	24-hour	H2H	2004	14.0	Uintah	Utah
		H2H	2005	18.0	Uintah	Utah
		H2H	2006	16.0	Uintah	Utah
	Annual	H	2004	5.0	Uintah	Utah
		H	2005	7.0	Uintah	Utah
		H	2006	7.0	Uintah	Utah
PM with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$)	24-hour	98th percentile	2007	27.0	Utah	Utah

[1] H = Highest value recorded; H2H = High Second High (second highest value from the highest receptor site); and 98th percentile = 2007 value selected as representative from the UDAQ $PM_{2.5}$ Vernal monitoring data set (**Appendix G**).

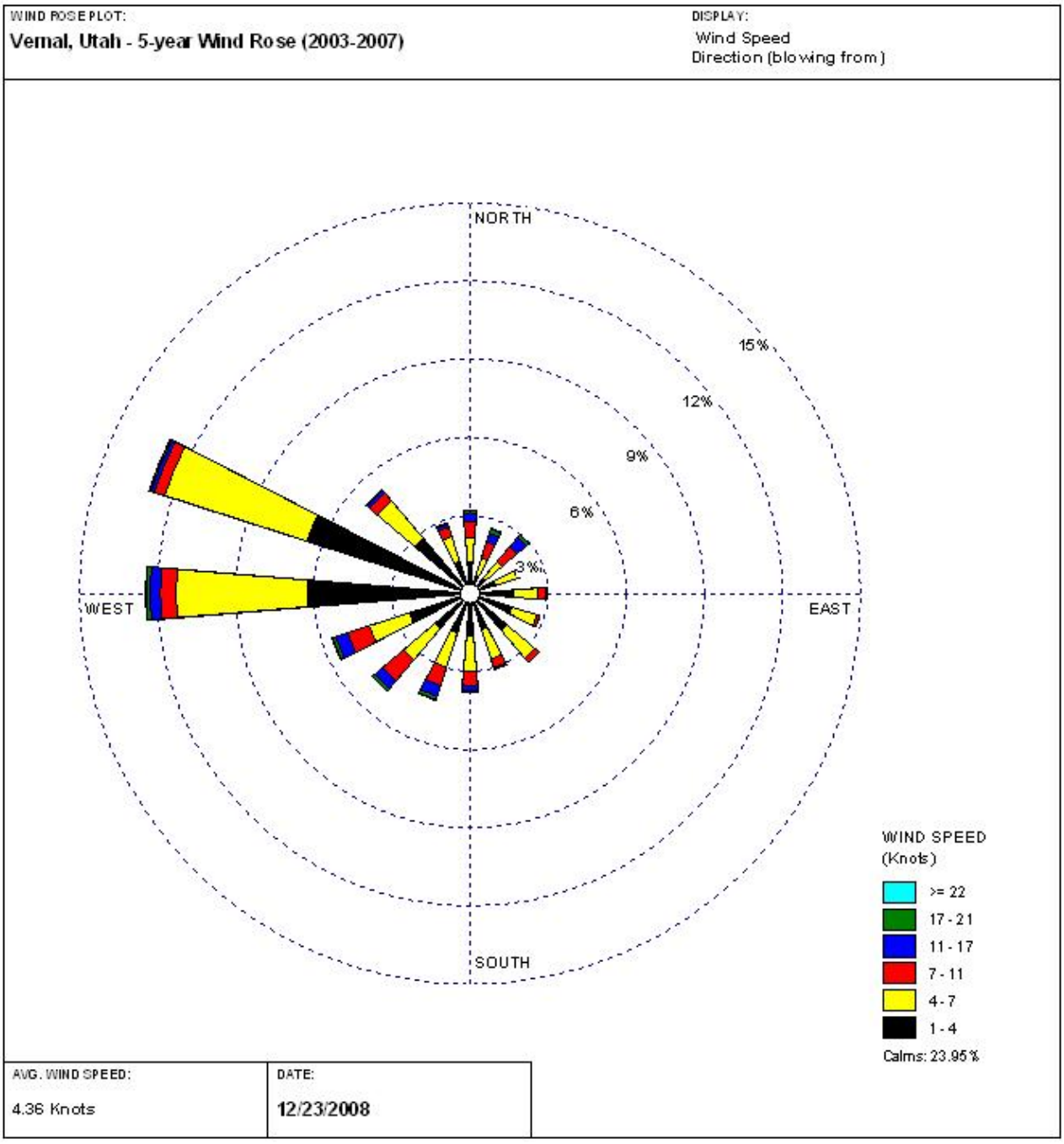


Figure 3.1-1 Wind Rose from Vernal, Utah, Airport

3.1.3 Regulatory Framework

The CAA of 1970 (42 USC 7401 et seq.) as amended in 1977 and 1990 is the basic federal statute governing air pollution. Provisions of the CAA of 1970 that potentially are relevant to the GNBPA are listed and discussed below:

- NAAQS;
- Prevention of Significant Deterioration (PSD);
- Nonattainment New Source Review (NNSR);
- Conformity Regulations;
- New Source Performance Standards (NSPS); and
- Maximum Achievable Control Technology (MACT) Standards.

3.1.3.1 National Ambient Air Quality Standards

The Federal CAA amendments of the 1990s require all states to control air pollution emission sources so that NAAQS are met and maintained. In addition to these requirements, the National Park Service (NPS) Organic Act requires the NPS to protect the natural resources of the lands it manages from the adverse effects of air pollution.

The NAAQS establishes maximum acceptable concentrations for oxides of nitrogen (NO_2/NO_X), CO, SO_2, PM_{10}, $PM_{2.5}$, ozone, and lead. Given the extremely low levels of lead emissions from project sources, the lead standards are not addressed in this analysis. These pollutants are known as criteria pollutants. The NAAQS are established by the USEPA and are outlined in 40 CFR 50. These standards represent the maximum allowable atmospheric concentrations that may occur without jeopardizing public health and welfare, and include a reasonable margin of safety to protect the more sensitive individuals in the population. The NAAQS represent maximum acceptable concentrations that generally may not be exceeded more than once per year; the annual standards may never be exceeded. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. The State of Utah has adopted the NAAQS as the SAAQS. Applicable federal and state criteria are presented in **Table 3.1-3**.

3.1.3.2 Prevention of Significant Deterioration

PSD regulations restrict the degree of ambient air quality deterioration allowed and apply to proposed new or modified major stationary sources located in an attainment area that have the potential to emit criteria pollutants in excess of predetermined de minimis values (40 CFR Part 51). Increments for criteria pollutants are based on the PSD classification of the area. Class I area status is assigned to federally protected wilderness areas and allows the lowest amount of permissible deterioration. Class I areas allow the lowest amount of air quality increment consumption, while Class II designations allow higher increment consumption. There are no designated Class III or heavy industrial use areas.

As defined in 40 CFR 51, a source is a major stationary source if it:

1. Can be classified in one of the 28 named source categories listed in Section 169 of the CAA and it emits or has the potential to emit 100 tons per year (tpy) or more of any pollutant regulated by the Act; or

2. Is any other stationary source that emits or has the potential to emit 250 tpy or more of any pollutants regulated by the CAA (USEPA 1990).

Compressor stations and other upstream oil and gas sources are not listed as one of the 28 named source types in Section 169 of the Act; therefore, 250 tpy is the threshold for major source status.

Table 3.1-3 National Ambient Air Quality Standards

Pollutant (units)	Averaging Period	Ambient Air Quality Standards[1]			
		National	Wyoming	Utah	Colorado
NO_2 (µg/m^3)	Annual[2]	100	100	100	100
CO (µg/m^3)	1-hour[3]	40,000	40,000	40,000	40,000
	8-hour[3]	10,000	10,000	10,000	10,000
SO_2 (µg/m^3)	3-hour[3]	1,300	1,300	1,300	1,300
	24-hour[3]	365	260	365	365
	Annual[2]	80	60	80	80
PM_{10} (µg/m^3)	24-hour[4]	150	150	150	150
	Annual[2]	--[7]	50	50	50
$PM_{2.5}$ (µg/m^3)	24-hour[5]	35	35	35	35
	Annual[6]	15	15	15	15
Ozone (ppm)	8-hour[8]	0.075	0.075	0.075	0.075

[1] Sources: USEPA 2009a, WDEQ 2008, UDAQ 2008, and CDPHE 2007.
[2] Never to be exceeded.
[3] Not to be exceeded more than once per year.
[4] Not to be exceeded more than once per year on average over 3 years.
[5] Three-year average of the 98th percentile of the 24-hour concentrations at each population-oriented monitor within an area must not exceed this standard.
[6] Three-year average of the weighted annual mean concentrations from single or multiple community-oriented monitors must not exceed this standard.
[7] The annual PM_{10} NAAQS of 50 µg/m^3 was revoked by USEPA on September 21, 2006. See Federal Register Volume 71, Number 200, October 17, 2006.
[8] Values provided reflect the new standard of 0.075 ppm. Three-year average of the fourth highest daily maximum 8-hour average measured at each monitor within an area over each year must not exceed this standard.

In addition to more stringent PSD increments, Class I areas are protected by Federal Land Managers (FLMs) by management of air quality related values (AQRVs) such as visibility and acid deposition. Though not a regulatory program under PSD, FLMs review the issuance of a PSD permit for any impacts that exceed guideline thresholds for these parameters. The air quality impacts in the area must meet the NAAQS, which apply nationwide. The nearest Class I area is Arches National Park about 80 miles south of the GNBPA. See **Table 3.1-4** for a complete list of Class I and Class II areas considered in the air quality analysis.

Table 3.1-4 Class I and Sensitive Class II Areas of Concern for Air Quality Impact Analysis

NPS Class I Areas
Arches National Park
Black Canyon of the Gunnison National Park
Canyonlands National Park
Capitol Reef National Park
Mesa Verde National Park
USFS Class I Areas
Eagles Nest Wilderness Area
Flat Tops Wilderness Area
La Garita Wilderness Area
Maroon Bells-Snowmass Wilderness Area
Mount Zirkel Wilderness Area

Table 3.1-4 Class I and Sensitive Class II Areas of Concern for Air Quality Impact Analysis

Weminuche Wilderness Area
West Elk Wilderness Area
NPS Class II Areas
Colorado National Monument
Dinosaur National Monument
USFS Class II Areas
Flaming Gorge National Recreation Area
High Uintah Wilderness Area
Holy Cross Wilderness Area
Hunter/Frying Pan Wilderness Area
Raggeds Wilderness Area
USFWS Class II Areas
Browns Park National Wildlife Refuge

Allowable deterioration to air quality can be expressed as the incremental increase to ambient concentrations of criteria pollutants, or PSD increment. Modeled air concentrations of NO_2, SO_2, and PM_{10} predicted at near-field receptors that result from the emissions due to project sources are compared with the convenient threshold of allowable PSD increments. This comparison to PSD Class II increments does not represent a regulatory PSD increment consumption analysis because the focus of this study is the Proposed Action and alternatives under NEPA, not increment-affecting sources, which are not evaluated for regulatory purposes under NEPA. The allowable PSD increments for Class II areas are given in **Table 3.1-5**.

Table 3.1-5 PSD Increments for Class I and Class II Areas

PSD Class	Pollutant	Allowable Increment (µg/m^3)		
		Annual Arithmetic Mean	24-hour Maximum	3-hour Maximum
Class I	NO_2	2.5	-	-
	SO_2	2	5	25
	PM_{10}	4	8	-
Class II	NO_2	25	-	-
	SO_2	20	91	512
	PM_{10}	17	30	-

3.1.3.3 Nonattainment New Source Review

NNSR is required for major stationary sources locating or expanding in nonattainment areas. The areas potentially impacted by the proposed project are currently in “attainment” for all criteria pollutants; therefore, NNSR does not apply.

3.1.3.4 Conformity for General Federal Actions

According to Section 176I of the CAA (40 CFR 51.853), a federal agency must make a conformity determination in the approval of a project having air emissions that exceed specified thresholds in

nonattainment and/or maintenance areas. The proposed project is not located in a nonattainment or maintenance area; therefore, a general conformity analysis is not required.

3.1.3.5 New Source Performance Standards

The regulation of new sources, through the development of standards applicable to a specific category of sources, was a significant step taken by the CAA. The significant feature of the law is that it applies to all new, modified, or reconstructed sources within a given category, regardless of geographic location or the existing ambient air quality. The standards defined emission limitations that would be applicable to a particular source group. The NSPS potentially applicable to the project include the following subparts of 40 CFR Part 60:

- Subpart A – General Provisions;
- Subpart Kb – Standards of Performance for Volatile Organic Storage Vessels;
- Subpart JJJJ – Standards of Performance for Stationary Spark-Ignition Internal Combustion Engines; and
- Subpart KKKK – Standards of Performance for Stationary Combustion Turbines.

Subpart A – General Provisions

Certain provisions of Subpart A apply to the owner or operator of any stationary source subject to a NSPS. Provisions of Subpart A potentially would apply depending on the size and type of compressor-drivers to be installed.

Subpart Kb – Volatile Organic Liquid Storage Vessels

Subpart Kb applies to storage vessels containing volatile organic liquids with a capacity greater than 75 m^3 (approximately 19,800 gallons). This subpart potentially would be applicable to storage tanks for natural gas liquids and pipeline liquids tanks located at pump or meter stations.

NSPS JJJJ – Spark Ignition Internal Combustion Engines

On January 18, 2008, the USEPA published in the Federal Register the finalized rule for NO_X, CO, and non-methane hydrocarbons from certain new stationary spark-ignited internal combustion (IC) engines that commence construction, modification, or reconstruction after the date the particular standard for a specified engine is identified. For the purposes of this Subpart, the date that construction commences is the date that the engine is ordered by the owner or operator. The requirements of this Subpart apply to owners and operators of stationary spark-ignition (SI) IC engines that commence construction after June 12, 2006, where IC engines greater than or equal to 500 hp are manufactured on or after July 1, 2007, and where emergency generator engines are manufactured on or after January 1, 2009.

Subpart KKKK – Stationary Combustion Turbines

On February 18, 2005, the USEPA published proposed rules in the Federal Register for NO_X and SO_2 from new stationary combustion turbines that are larger than 1 megawatt that commence construction, modification, or reconstruction after February 18, 2005. The preamble to the proposed rule states that new stationary combustion turbines subject to the proposed standards are exempt from the requirements of 40 CFR 60, Subpart GG. Combustion turbines that operate in emergency situations are exempt from the new regulations. The USEPA promulgated the new combustion turbine, Subpart KKKK rule on July 6, 2006.

3.1.3.6 National Emission Standards for Hazardous Air Pollutants

Under the National Emission Standards for Hazardous Air Pollutants, the USEPA promulgated MACT standards pursuant to Section 112 of the 1990 CAA Amendments and these rules are provided in 40 CFR 63. The MACT standards that potentially would be applicable to the proposed project include:

- Subpart A – General Provisions;
- Subpart HH – Oil and Natural Gas Production Facilities;
- Subpart YYYY – Stationary Combustion Turbines; and
- Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines

Subpart A – General Provisions

The general provisions for all sources affected by a MACT standard are promulgated under Subpart A. Each of the promulgated standards contains a detailed list of Subpart A that is applicable to the affected facility. The critical sections of Subpart A are summarized in Section 63.6, specifically including paragraph 63.6(e), which provides operation and maintenance requirements.

Subpart HH – Oil and Natural Gas Production Facilities

In the January 3, 2007, Federal Register, the USEPA promulgated a rule to amend 40 CFR 63, Subpart HH to include area sources rather than just major sources of HAPs. An affected source under this final rule is each tri-ethylene glycol dehydration unit located at an area source oil and natural gas production facility.

Subpart YYYY – Stationary Combustion Turbines

The USEPA published the final stationary combustion turbine MACT rule in the Federal Register on March 5, 2004. New lean premix and diffusion flame gas- and oil-fired turbines at major HAP facilities are required to limit formaldehyde emissions to 91 parts per billion volume dry at 15 percent oxygen. On April 7, 2004, the USEPA published two proposed rules affecting natural gas-fired lean premix combustion turbines and three other subcategories. On August 18, 2004, USEPA issued a final rule to stay of the effectiveness for two categories of stationary combustion turbines: lean pre-mix gas-fired turbines and diffusion flame gas-fired turbines.

Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines

On January 18, 2008, the USEPA published in the Federal Register finalized rules to amend 40 CFR 63, Subpart ZZZZ. An affected source under this amended Subpart is any existing, new, or reconstructed stationary reciprocating internal combustion engine with a site-rating of more than 25 brake horsepower, which are located at either a major source or area source of HAPs.

3.1.3.7 Carbon Dioxide and Other Greenhouse Gases

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) GHG emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2(e) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that warming of the climate system is unequivocal and most of the observed increase in globally average temperatures since the mid-20th century very likely is due to the observed increase in anthropogenic GHG concentrations (IPCC 2007).

Global mean surface temperatures increased nearly 1.8°F from 1890 to 2006. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24°N) have exhibited temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

In 2001, the IPCC projected that by the year 2100, global average surface temperatures could increase by 2.5 to 10.4°F above 1990 levels. The National Academy of Sciences (2010) has confirmed these projections, but also has indicated that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature would not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict.

As with any field of scientific study, there are uncertainties associated with the science of climate change; however, this does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty because they are based on well-known physical laws and documented trends (USEPA 2010).

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially CO_2 and methane [CH_4]) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 may influence climate for 100 years.

It may be difficult to discern whether climate change is already affecting resources globally, let alone those in the vicinity of the proposed project. In most cases, there is little information about potential or projected effects of global climate change on resources. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change may not be measurably discernible within the reasonably foreseeable future. Existing climate prediction models are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the vicinity of the project.

In *Massachusetts v. EPA*, the U.S. Supreme Court (April 7, 2007) held that carbon dioxide (CO_2) satisfies the definition of “air pollutant” and that USEPA has authority to regulate emissions of CO_2 and other GHGs from new motor vehicles under the CAA. The Supreme Court remanded the case to USEPA to determine whether such motor vehicle emissions contribute to global climate change, and thereby endanger public health or welfare. The ruling, however, did not require the USEPA to create any emission control standards or ambient air quality standards for GHG emissions.

CO_2 and other GHGs are naturally occurring gases in the atmosphere whose status as a pollutant is not related to their toxicity, but to the added long-term impacts they may have on climate because of their increased incremental levels in the earth’s atmosphere. Because they are non-toxic and non-hazardous at normal ambient concentrations, CO_2 and other naturally occurring GHGs are not regulated under the major environmental regulatory programs that primarily address toxic and hazardous substances.

On October 30, 2009, the USEPA issued the final mandatory reporting rule for major sources of GHG emissions. The rule requires a wide range of sources and source groups to record and report selected GHG emissions, including CO_2, CH_4, nitrous oxide (N_2O), and some halogenated compounds. The USEPA delayed a comparable rule for GHG emissions for various natural gas industry groups. On April 10, 2010, the USEPA proposed an additional subpart of the original rule to address natural gas production and natural

gas transmission source groups, among others. The USEPA expects to promulgate a final rule for these sources by October 2010.

The proposed rule for natural gas sources specifically identifies monitoring and reporting requirements for oil and natural gas systems. The oil and natural gas source category includes on-shore natural gas processing facilities and on-shore natural gas transmission compression facilities, which are applicable components of the proposed project. Combustion units associated with these processes also are included as part of the separate final rule. The USEPA specifically seeks comments on reporting of the major fugitive emissions by corporations at the basin level.

The USEPA proposed and final rules do not require any controls or establish any standards related to GHG emissions or impacts. Therefore, there is no evident requirement at this time that would affect development of the proposed project under the proposed rule, other than the possibility of monitoring, recordkeeping, and reporting of GHG emissions.

3.2 Cultural Resources and Native American Traditional Values

The study area for cultural resources and Native American traditional values is defined as the GNBPA.

3.2.1 Cultural Resources

Cultural resources are those aspects of the physical environment that relate to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources include prehistoric and historic sites and ethnographic resources. Prehistoric and historic sites are the tangible remains of past activities that show use or modification by people. They are distinct geographic areas that can include artifacts; features such as hearths, rock alignments, trails, rock art, railroad grades, canals and roads; landscape alterations; or architecture. The reader is referred to Section 3.2.2, Native American Traditional Values, for the discussion of ethnographic resources.

3.2.1.1 Cultural Resources Overview

The following prehistoric and historic contexts are derived from *NBU Class I Existing Data Review for Kerr-McGee Oil & Gas Onshore LP, Uintah County, Utah* (Patterson et al. 2008) and the Final Castle Peak and Eightmile Flat Oil and Gas Expansion Project EIS (BLM 2005).

3.2.1.2 Prehistoric Resources

The prehistoric chronological sequence represented in the GNBPA includes the Paleoindian, Archaic, Formative, Fremont, and Protohistoric stages. The earliest inhabitants of the region are representative of the Paleoindian stage (ca. 12,000-8000 B.P.). Adaptation to terminal Pleistocene environments and big-game hunting are characteristic of the Paleoindian stage. In the Uinta Basin, few Paleoindian sites have been adequately documented, and most evidence of Paleoindian exploitation of the area is restricted to isolated projectile points recovered in non-stratigraphic contexts.

The Archaic stage is broken down into Early Archaic (ca. 8000-5000 B.P.), Middle Archaic (ca. 5000-700 B.P.), and Late Archaic 700 B.P. to A.D. 550). The Early Archaic is characterized by the dependence on a foraging subsistence, with a seasonal exploitation of a wide variety of plant and animal species in different ecozones. Dependence on these resources involved the ability to shift camps from one available food source to another. The Middle Archaic is characterized by improved climatic conditions and an increase in human population on the northern Colorado Plateau. Subsistence included plant gathering and processing, as well as big-game and small-game hunting. During this stage, the use of rock shelters, overhangs, and open camps was common throughout the Uinta Basin. The Late Archaic is defined by changes in subsistence strategies and settlement patterns. By about A.D. 100, maize horticulture is added to the Archaic life way. Domesticated agriculture required a greater level of sedentism, which is evidenced by semi-permanent architecture and storage features. In addition, there are indications of complex burial practices, which suggest a shift in social structure.

The Formative stage (A.D. 500-1300) is recognized in the area as the Uinta Fremont. This stage is characterized by continued foraging with a reliance on domesticated corn and squash, and increased sedentism. Later in the stage, substantial habitation structures, pottery, and changes in bow and arrow technology appear. Based on archaeological evidence, the temporal range of the Uinta Fremont appears to be from A.D. 650 to 950. Rock art styles often are used as culturally diagnostic attributes of the Fremont. Fremont-style rock art includes petroglyphs, rock paintings, and a combination of petroglyphs and rock paintings.

Archaeological evidence suggests that Numic-speaking people (Utes) appeared in the region at approximately A.D. 1100. Remnants of Numic-speaking Utes primarily consist of lithic scatters with low quantities of brown ware ceramics, rock art, and occasional wickiups.

3.2.1.3 Historical Resources

The earliest recorded visit by Europeans to Utah was the Dominguez-Escalante expedition in 1776. With the exception of the Dominguez and Escalante expedition, few explorers ventured into Ute territory until the 1820s when a growing number of trappers passed through or established temporary trading posts. Between the 1820s and the 1840s, such men as William H. Ashley, Etienne Provost, Antoine Robidoux, and Kit Carson visited the basin and mountains. These travelers passed through the area via several routes. One northerly route from Santa Fe, today known as the Old Spanish Trail, was used from 1829 to 1848 to access that portion of eastern Utah near the present day town of Green River. Others came from the north following a number of trails, later to become such well-known routes as the Oregon, Overland, and Cherokee trails.

At least two semi-permanent trading posts were established in the Uinta Basin: Fort Robidoux, sometimes referred to as Fort Uintah or Winty (1830s-1844), and Fort Kit Carson (1833-1834). Several important U.S. government expeditions visited the area, including Captain John C. Fremont's expedition in the 1840s, and Major John Wesley Powell who floated down the Green River in 1869 and again in 1871. Fort Robidoux was established in 1832 at the confluence of the Uinta and Duchesne rivers and survived until late 1844 when Ute Indians routed the inhabitants just after John C. Fremont's visit. However, the Utah Historical Records Survey maintains that the Fort was established earlier, possibly by 1830, at the mouth of the White River.

The Uinta Basin was of little interest to most settlers during the initial phase of settlement in the Great Basin. In 1861, Brigham Young sent a formal Mormon exploration party to the Uinta Basin, but they soon returned to the Wasatch front range stating that the basin was too desolate, disappointing, and undesirable for settlement. Soon after, most of the Uinta Basin was set aside by Presidential proclamation for an Indian reservation. However, it was not until the late 1860s that most of the Utes residing in Utah Valley and areas south were relocated to the new Indian reservation.

By the early 1870s, Mormon ranchers began filtering into Ashley Valley, which first served as excellent summer feeding grounds for herds of cattle. The building of water flumes and canals through the late 1800s was crucial to farming success in this arid region, first tapping Ashley Creek along which the majority of the white population lived in the early years. By 1880, there was a permanent population sufficiently large enough for Uintah County to be established by the territorial legislature. By the 1890s, gilsonite and other asphaltum minerals were discovered in Uintah County, as well as on the eastern edges of the Indian reservations. A number of gilsonite camps were established along the Utah-Colorado border. During this time, freight and stagecoach traffic increased between the eastern GNBPA and Uintah Railway stations located first at Dragon and later at Watson. The Uintah Railway Company's Stage Line from Vernal to Watson is located in the GNBPA. The population grew slowly until August of 1905 when much of the Uintah Indian Reservation was declared open for white settlement. Thousands of potential homesteaders rushed to Vernal, Price, and Provo to register for the land drawing. Only a small fraction of registrants actually took up homesteads and many of those eventually gave up on their efforts to secure cheap farmland.

In 1904, a system of roads and telephone/telegraph lines were built. Roads were constructed from Green River to Vernal and Fort Duchesne. One of the main routes between these areas was the Ouray to Rangely wagon road, later known as the Watson Road. Segments of the Watson Road are located in the GNBPA. By 1916, most of the freight cargo from Watson to Vernal and Fort Duchesne was transported by motor vehicles. The Chapita Wells way-station, which is located in the GNBPA, was operated by the Uintah Toll Road Company from 1906 to the late 1930s or early 1940s.

Commercial oil production started in the 1950s, but was not fully exploited until the 1970s with the increased price of crude oil. This in turn spurred private and public ventures to develop an inexpensive process for separating oil from oil shale and tar sands. The oil development in the basin during the 1970s resulted in vigorous economic activity, an increase in the local population, increased school enrollment, and a shortage of housing. However, in 1980, international oil prices began to fall and the economic health of the Uinta Basin quickly fell.

The Uinta Basin has been susceptible to frequent economic boom-bust cycles. Currently, there is little evidence of past economic booms. The small population base of European-Americans and Indians is supported by a fragile economy based on farming, ranching, and the removal of oil and gas. It is increasingly influenced by worldwide energy prices.

Regulatory Framework

Federal historic preservation legislation provides a legal environment for documentation, evaluation, and protection of cultural resources that may be affected by federal undertakings, or by private undertakings operating under federal license, with federal funding, or on federally managed lands. These include the NHPA, as amended; the Archaeological and Historic Preservation Act (AHPA) of 1974; and the ARPA, as amended. EO 11593 also provides necessary guidance on protection and enhancement of cultural resources.

The NHPA requires federal agencies to take into account the effects of their actions on properties listed on or eligible for listing on the National Register of Historic Places (NRHP). Section 106 of the NHPA establishes a four-step review process by which cultural resources are given consideration during the evaluation of proposed undertakings. The regulations require that federal agencies initiate Section 106 early in the project planning, when a broad range of alternatives can be considered (36 CFR 800.1[c]).

Eligibility Criteria for Listing Cultural Resources on the NRHP

The NRHP, maintained by the NPS on behalf of the Secretary of the Interior, is the nation's inventory of significant cultural resources. The NPS has established three main standards that a resource must meet to qualify for listing on the NRHP: age, integrity, and significance. To meet the age criteria, a resource generally must be at least 50 years old (except in special circumstances). To meet the integrity criteria, a resource must "possess integrity of location, design, setting, materials, workmanship, feeling, and association" (36 CFR 60.4). Finally, a resource must be significant according to one or more of the following criteria:

- Be associated with events that have made a significant contribution to the broad patterns of U.S. history (Criterion A); or
- Be associated with the lives of persons significant in U.S. history (Criterion B); or
- Embody the distinctive characteristics of a type, period, or method of construction or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); or
- Have yielded, or may likely yield, information important in prehistory or history (Criterion D) (NPS 1995).

Cultural Resources Investigations in the GNBPA

Numerous Class I (files search) and Class III (field survey) large-scale cultural resource inventories have been conducted in the GNBPA for oil field development, including associated access roads and pipelines. Several small-scale, site-specific block surveys also have been conducted in the GNBPA. The objective of these previous inventories was to locate, document, and evaluate any cultural resources within the GNBPA pursuant to a determination of effect to NRHP-eligible sites in accordance with Section 106 of the NHPA. In summer and fall 2008, a Class III inventory was conducted of remaining portions of the GNBPA that had not been previously surveyed. The results of the 2008 Class III inventory and inventories previously conducted in the GNBPA are in the process of being combined into one Class III inventory report for the proposed project. Once completed, the Class III inventory report will be submitted to the BLM Vernal Field Office and Utah SHPO for review. The following paragraphs are brief summaries of the inventory data found in the Class III inventory report (Patterson 2009).

Class I Files Search Results

Between June 2006 and January 2007, a Class I files search of 459 square miles (293,805 acres) covering an area between Bonanza and Ouray in Uintah County was conducted at the Utah SHPO and the BLM Vernal Field Office (Patterson et al. 2008). In addition, Government Land Office maps of the GNBPA were examined to identify potential historic cultural resources including homesteads, roads, and similar resources. The files search also identified all lands within the GNBPA that had not been previously inventoried for cultural resources. As a result of the files search, 1,820 cultural resource inventories and 1,212 cultural resources were identified in the GNBPA. Based on the files search data, the average site density of previously recorded prehistoric and historic sites within the GNBPA is estimated at 7.1 sites per square mile.

Of the 1,212 sites identified in the Class I files search, 413 (34 percent) are recommended as eligible to the NRHP, 772 sites (63.6 percent) are not eligible, and 27 sites (3.0 percent) are unevaluated and require additional research to determine their eligibility for the NRHP. The majority of eligible sites are prehistoric sites eligible under Criterion D due to their potential to provide important information on the prehistory or history of the area. Other eligible site types include rock art panels, historic roads, gilsonite mines, and a limited number of historic temporary camps, trash scatters, and cairns. Cairns consist of small to large stacked stones used to demarcate section corners, claims, and line-of-site markers. The 772 sites determined as not eligible for the NRHP are predominately historic temporary camps and trash scatters. The 27 unevaluated sites consist of 19 prehistoric artifact scatters of unknown cultural affiliation, 4 prehistoric temporary camps of unknown cultural affiliation, 2 historic inscriptions, 1 unaffiliated prehistoric rock art site, and 1 unaffiliated prehistoric rock shelter.

Class III Field Survey Results

Prehistoric Sites

Prehistoric cultural resources located in the GNBPA were classified as one or more of eight site types. The site types include camp sites, habitation sites, human remains, lithic quarries, lithic scatters, rock art, rock shelters, and stone circles. Camp sites typically contain evidence of temporary habitation in the form of domestic trash and the presence of features such as hearths, cists, and tent rings. Lithic scatters are often similar to camp sites, but lack constructed features. Habitation sites refer to sites occupied either continuously or seasonally for extended periods of time. Habitation sites often contain features that required substantial investments of time or resources to construct, such as standing architecture or slab-lined storage cists. Human remains consist of human bones or skeletons and associated funerary objects. Lithic quarries refer to tool stone sources utilized by prehistoric inhabitants of the area. Rock art refers to sites containing either petroglyphs or pictographs on cliffs or boulders. The distinguishing characteristic of a rock shelter is a natural alcove in a cliff or large boulder that was utilized by prehistoric inhabitants of the area; rock shelters may have served as camp or habitation sites. Finally, stone circles consist of closed alignments of rocks. Though the exact function of stone rings is not readily identifiable from their surface manifestations, it is likely that the circles represent tent rings, shrines, or markers.

Table 3.2-1 lists the site type and cultural affiliation of known prehistoric sites in the GNBPA, including both previously recorded sites and sites identified during the 2008 cultural resource inventory. In total, 877 prehistoric sites are known to be present in the GNBPA. The majority of the sites (801) could not be categorized as belonging to any particular cultural affiliation due to the absence of temporal or diagnostic indicators. Of the sites that could be classified as belonging to a particular period, most date in the Archaic period (41 sites). Fremont sites represent the second most commonly identified affiliation. Numic and Paleoindian sites represent minor portions of the archaeological record in the GNBPA.

Table 3.2-1 Prehistoric Site Types and Cultural Affiliations

Site Type	Paleoindian	Early Archaic	Middle Archaic	Late Archaic	Archaic (General)	Fremont	Numic	Unknown Aboriginal	Total
Camp Site		1		2	10	5	4	166	**188**
Camp Site, Lithic Quarry								3	**3**
Habitation Site						1		1	**2**
Habitation Site, Human Remains						1			**1**
Human Remains								1	**1**
Lithic Quarry								48	**48**
Lithic Scatter	3	5	4	1	14	3	2	469	**501**
Rock Art			1			5	3	10	**19**
Rock Art, Rock Shelter						1			**1**
Rock Shelter					3	4	3	99	**109**
Stone Circle								4	**4**
Total	**3**	**6**	**5**	**3**	**27**	**20**	**12**	**801**	**877**

In general, lithic scatters account for over half of the prehistoric sites documented in the GNBPA; camp sites are the second most common site type. Less common site types include habitation sites, stone circles, rock art, and sites containing human remains. The general absence of habitation sites in this portion of the Uinta Basin is not entirely unexpected given the low diversity of resources, the lack of permanent water sources away from the major rivers and creeks, and the overall terrain of the GNBPA. These same factors may partially account for the low frequency of identified rock art sites relative to surrounding areas. Prehistoric human remains were identified at two sites in the GNBPA.

Historic Sites

Compared to prehistoric sites, the types of historic sites are more complex given the nature of varying land use systems and the extraction of commercial resources. Many of the historic site types fall into one or more land use categories, including homesteading and ranching, resource development and extraction, and indigenous land use. Ranching and homesteading site types commonly include homesteads, corrals, temporary camps, trails, and stock driveways, certain classes of cairns, and trash scatters. Resource extraction and development sites include certain types of cairns (e.g., claim markers), mines, utility lines, roads, bridges, and sites related to the Civilian Conservation Corps (CCC). Historic sites related to continued use of the landscape by the Ute Indians include teepee rings and trash scatters, temporary camps, rock art, and graves. Other types of sites, including inscriptions, rock alignments, and rock concentrations, do not fit neatly into any of the broad land use classifications. Both inscriptions (e.g., names, initials, dates, brands) and rock art are included in the historic sites.

Table 3.2-2 lists the site types and cultural affiliations of historic sites identified in the GNBPA, including both previously recorded sites and sites identified during the 2008 cultural resource inventory. In total, 897 historic sites are known to be present in the GNBPA. Most of the historic sites are associated with Euro-Americans and include cairns, temporary camps, and trash scatters. While some of these sites have ambiguous or unknown functions, it likely is that most are associated with ranching activities. Corrals and homesteads, though much less common in the GNBPA, further support a strong historic ranching-based economy. Sites related to development and resource extraction are less common in the GNBPA. Two sites are identified as related to the CCC: one site is a temporary camp documented in the historic literature and the second is a road grader with the letters “CCC” painted on its side. Other development-related sites include the old Ouray Bridge, numerous historic freight and coach roads, and an old power/telegraph line. One of the 13 documented graves is associated with Euro-Americans.

Table 3.2-2 Historic Site Types and Cultural Affiliations

Site Type	European American	Ute	European American or Ute	Total
Cairn	246			**246**
Cairn (Claim Marker)	3			**3**
Cairn, Inscription	1			**1**
Cairn, Temporary Camp	1			**1**
Cairn, Trash Scatter	3			**3**
CCC Temporary Camp	1			**1**
Corral	19		7	**26**
Corral (Lambing Pen)	1			**1**
Feed Trough	1			**1**
Grave	1	12		**13**
Grave, Stone Circle		3		**3**
Homestead	3		5	**8**
Inscription	13	13	2	**28**
Livestock Driveway	2			**2**
Mine	12			**12**
Road	7			**7**
Road Grader (CCC)	1			**1**
Rock Alignment	3		1	**4**
Historic Rock Art	12	12		**24**
Rock Concentration		2	1	**3**
Rock Shelter	1			**1**
Temporary Camp	246	6	16	**268**
Teepee Ring		3		**3**
Trail	1			**1**
Trash Scatter	216		18	**234**
Bridge	1			**1**
Utility Line	1			**1**
Total	**796**	**51**	**50**	**897**

Sites affiliated with the Ute Indian Tribe include potential graves, rock art panels and inscriptions, temporary camps, and teepee rings and/or rock concentrations. The majority of the Ute-affiliated sites occur on the Uintah and Ouray Reservation. Sites listed as either Euro-American or Ute also mostly occur on Tribal land, but lack any diagnostic Ute characteristic making it difficult to assign them to one particular cultural affiliation. In general, the types of sites classified in this group are relatively common to both the Ute and their Euro-American counterparts.

Multicomponent Sites

Multicomponent sites consist of cultural resources with at least two distinct cultural affiliations or temporal periods and are spatially associated with one another. As applied here, multicomponent sites consist of the same site types and cultural affiliations described above for prehistoric and historic sites. **Table 3.2-3** lists the multicomponent sites identified in the GNBPA, including both previously recorded sites and sites identified during the 2008 cultural resource inventory. In total, 39 multicomponent sites are known to be present in the GNBPA. The most common multicomponent site types are prehistoric lithic scatters and historic trash scatters. All but eight of the multicomponent sites have a Euro-American component. The majority of the multicomponent sites contain both prehistoric and historic components. One site has multiple prehistoric components; no sites have multiple historic components.

Table 3.2-3 Multicomponent Site Types and Cultural Affiliations

Site Types	Archaic, European American	Archaic, European American or Ute	Archaic, Fremont, European American	Early Archaic, European American	Early Archaic, Fremont	European American, Ute, Numic	Fremont, European American	Fremont, European American, Ute	Fremont, Ute	Paleoindian, European American	Numic, European American	Unknown Aboriginal, European American, Ute	Unknown Aboriginal, Fremont, European American, Ute	Unknown Aboriginal, European American	Unknown Aboriginal, Ute	Total
Cairn, Lithic Scatter														1		**1**
Camp Site					1										1	**2**
Camp Site, Corral					1									1		**1**
Camp Site, Rock Art, Inscriptions							1									**1**
Camp Site, Trash Scatter				1												**1**
Habitation, Inscription							1									**1**
Lithic Scatter, Homestead															1	**1**
Lithic Scatter, Inscription												1			1	**2**
Lithic Scatter, Road														1		**1**
Lithic Scatter, Temporary Camp											1			1		**2**
Lithic Scatter, Trash Scatter	1	1								1				8		**11**
Lithic-Ceramic Scatter, Trash Scatter								1								**1**
Rock Art			1						1						2	**4**
Rock Art, Corral														1		**1**
Rock Art, Inscription						1	1									**2**
Rock Art, Lithic Scatter, Inscription							1						1			**2**
Rock Shelter											2			1		**3**
Rock Shelter, Inscription														1		**1**
Rock Shelter, Trash Scatter	1															**1**
Total	**2**	**1**	**1**	**1**	**2**	**1**	**4**	**1**	**1**	**1**	**3**	**1**	**1**	**15**	**5**	**39**

NRHP Eligibility of Sites Identified in the GNBPA

Table 3.2-4 lists sites either recommended or evaluated as eligible for listing on the NRHP based on one or more of the four NRHP criteria, as well as the land ownership of each site. It should be noted that **Table 3.2-4** is preliminary and subject to change pending review by the BLM and SHPO of the Class III inventory report currently being prepared for the proposed project. NRHP eligibility has been determined for approximately 580 sites. These sites include cultural resources recorded or re-recorded during the 2008 Class III inventory. Concurrence by the BLM and SHPO is pending on approximately 300 additional sites. Depending on the outcome of agency review, eligibility recommendations may change.

Table 3.2-4 Site Eligibility and Land Status

	BLM	BLM, Private	BLM, USITLA	Private	USITLA	Ute Tribal	Ute Tribal, BLM	Ute Tribal, Private	Total
Eligible	258	4	8	11	93	367	4	0	**745**
Not Eligible	615	6	16	18	166	244	1	1	**1,067**
Total	**873**	**10**	**24**	**29**	**259**	**611**	**5**	**1**	**1,812**

3.2.2 Native American Traditional Values

Ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. Examples of ethnographic resources include places, such as particular rock formations, the confluence of two rivers, or a rock cairn; large areas, such as landscapes and viewscapes; sacred sites and places used for religious practices; social or traditional gathering areas, such as dance areas; natural resources, such as plant materials or clay deposits used for arts, crafts, or ceremonies; and places and natural resources traditionally used for non-ceremonial uses, such as trails or camping locations.

3.2.2.1 Ethnographic Overview

The following ethnographic overview is derived from *NBU Class I Existing Data Review for Kerr-McGee Oil & Gas Onshore LP, Uintah County, Utah* (Patterson et al. 2008) and the Final Castle Peak and Eightmile Flat Oil and Gas Expansion Project EIS (BLM 2005).

Ute Indians can be divided into eastern and western groups. The eastern Utes inhabited the high plateaus and Rocky Mountain parks of Colorado and northern New Mexico, and consisted of the Yamparka and Parianuc (White River Utes), the Taviwac (Uncompahgre Utes), and the Wiminuc, Kapota, and Muwac (Southern and Ute Mountain Utes). The western or Utah Utes inhabited the central and eastern two-thirds of the state. Utah Ute bands included the Cumumba or Weber Utes, the Tumpanuwac, Uinta-ats, Pahvant, San Pitch, and Sheberetch. The bands traded and intermarried with each other, but did not form large Tribal organizations. Principally hunters and gatherers, the semi-nomadic Utah Utes gathered seeds and berries in season, dug roots, fished, hunted small game, and occasionally killed mountain buffalo.

Utes in Colorado acquired horses from the Spanish by 1640; however, the Utah Ute, being farther away from the Spanish frontier, acquired horses sometime later, possibly by 1680. With acquisition of the horse, the Ute quickly adopted the horse and buffalo culture of the Plains Indians. They became noted raiders and traded horses between the Spanish Southwest and the northern plains. Utes actively participated in Spanish attacks against Navajo and Apache raiders, and conducted their own slave trade with the Spanish against the Southern Paiute and Navajo.

Beginning in 1847, Utes experienced the full impact of Euro-American contact with the arrival of Mormon settlers. The Mormons rapidly extended their settlements south into the Utah Valley, a major trade crossroads and subsistence area for the Ute People. As conflicts increased between the Mormons and Utes, the federal government was pressured by the Mormons to put the Indians on a reservation. In 1861, Abraham Lincoln issued an EO creating the Uintah Valley Reservation, comprising 2,039,400 acres in the Uinta Basin. By 1870, most members of the Tumpanuwac, San Pitch, Pahvant, Sheberetch, Cumumba, and Uinta-at bands of Utah Utes (collectively called the Uintah Band) resided on the Uintah Reservation. In 1881, the Yamparka and Parianuc bands were forced by the federal government to join the Uintah Band on the Uintah Reservation. In 1882, the Taviwac were moved to their own reservation, the 1,912,320 acre Uncompahgre (Ouray) Reservation, immediately south of the Uintah Reservation. The Uintah and Uncompahgre Reservations were combined into the present Uintah and Ouray Reservation in 1886. Today, the Yamparka, Parianuc, and Taviwac are collectively called the Northern Ute Tribe.

In 1905, the federal government allotted the reservations and opened the remainder for non-Indian entry. Each Ute received an 80- to 160-acre plot for farming and access to a communal grazing district. By 1909, the Uintah and Ouray Reservation shrank from nearly 4 million acres in 1882 to a jointly owned 250,000-acre grazing reserve and 1,283 individual allotments totaling 103,265 acres. Sales of individual allotments further reduced Ute holdings.

Following the Indian Reorganization Act of 1934, the Northern Ute Tribe began repurchasing alienated reservation lands. In 1948, the federal government returned some 726,000 acres to the Tribe in what is now called the Hill Creek Extension. In a 1986 decision, the U.S. Supreme Court upheld an Appeals Court ruling granting the Northern Ute Tribe "legal jurisdiction" over 3 million acres of alienated reservation lands. In the 1990s, the Northern Ute Tribe had grown to 3,000 members and became an increasingly powerful force in local and state politics. The Uintah and Ouray Reservation now encompasses approximately 4.5 million acres.

3.2.2.2 Regulatory Framework

Federal law and the BLM Manual H-8160-1 require the BLM to consult with Native American Tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on BLM-administered lands. This consultation includes the identification of places (i.e., physical locations) of traditional cultural importance to Native American Tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning Tribal origins, cultural history, or the nature of the world; locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Additionally, some of these locations may be considered sacred to particular Native American individuals or Tribes.

In 1992, the NHPA was amended to explicitly allow that "properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the NRHP." If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property. The term "traditional cultural property" first came into use within the federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1998) defines a traditional cultural property as "one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that a) are rooted in that community's history and b) are important in maintaining the continuing cultural identity of the community." To qualify for nomination to the NRHP, a traditional cultural property must be more than 50 years old, must be a place with definable boundaries, must retain integrity, and must meet certain criteria as outlined for cultural resources in the NHPA.

In addition to the NRHP eligibility, some places of cultural and religious importance also must be evaluated to determine if they should be considered under other federal laws, regulations, directives, or policies. These include, but are not limited to, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, American Indian Religious Freedom Act (AIRFA) of 1978, ARPA, and EO 13007 of 1996.

NAGPRA established a means for Native Americans, including Indian Tribes, to request the return of human remains and other sensitive cultural items held by federal agencies or federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and sensitive cultural items.

AIRFA established a federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

ARPA requires notification of the appropriate Indian tribe before approving a cultural resource use permit for the excavation (testing and data recovery) of archaeological resources, if the responsible federal land manager determines that a location having cultural or religious importance to the tribe may be harmed or destroyed.

EO 13007 defines a sacred site as any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, provided that the tribe or appropriately authoritative representative has informed the federal agency of the existence of such a site. In compliance with the NHPA, as amended, and the BLM Manual H-8160-1, the BLM initiated government-to-government consultation for the Greater Natural Buttes EIS on January 9, 2008, by sending letters to the following tribal groups: Ute Mountain Ute, Confederated Tribes of the Goshute Reservation, White Mesa Ute Council, Pueblo of Laguna, Southern Ute Tribal Council, Ute Indian Tribe, Santa Clara Pueblo, Hopi Tribal Council, Zia Pueblo, Navajo Nation, Northwestern Band of Shoshone Nation, and Eastern Shoshone Business Council.

At this time, three of the contacted Tribes have responded to the January 9, 2008, letter. Both the Pueblo of Laguna and Navajo Nation state that the proposed project would have no significant impact on any traditional cultural properties or historical properties of importance to the Tribes (Joe 2008; Antonio 2008). However, the Navajo Nation requested notification of any unanticipated discoveries unearthed during the course of the project, and the Pueblo of Laguna requested notification in the event any new archaeological sites are discovered and artifacts are recovered. The Hopi Tribe expressed concern with stone cairns previously documented in the GNBPA (Kuwanwisiwma 2007). To the Hopi, stone cairns found on canyon rims and outcrops or precipices are characteristic of Hopi shrines and are associated with prehistoric architecture in Nine Mile Canyon. In response to Hopi concerns, the BLM sent the site forms of nine stone cairn sites previously documented in the GNBPA to the Hopi Tribe. The Tribe was requested by the BLM to determine if any of the stone cairn sites are considered shrines by the Hopi and potentially significant. In a letter dated January 15, 2008, the Hopi stated that all nine stone cairn sites are considered potentially significant and potentially eligible for listing on the NRHP (Kuwanwisiwma 2008).

On July 10, 2009, the BLM and Director of the Hopi Office of Cultural Preservation visited several stone cairn sites in the GNBPA. According to the Director, the Hopi tribe has cultural connections with the Ute, and the possible occurrence of twin cairns may mark the coming together of Ute and Hopi clans. During the field visit, the Director examined and viewed the sites utilizing characteristics derived from Hopi cultural practices. At the time of the visit, the Director could not confirm whether any of the cairn sites were Hopi or ancestral Hopi. However, the Director plans to prepare a report that would summarize his findings, provide cultural affiliation and function of the sites, and indicate whether additional site visits are necessary.

3.3 Geology

The study area for geology is the GNBPA. The geologic environment includes geologic hazards, mineral resources, and features of bedrock and surficial rock units, as differentiated from soils (Section 3.9) and groundwater (Section 3.13.3). There were no issues specifically relating to geology identified during public scoping.

The GNBPA is located within the East Tavaputs Plateau portion of the Colorado Plateau physiographic province (Fenneman 1931). The Plateau forms part of the southern margin of the asymmetrical Uinta structural basin. The basin was formed contemporaneously with uplift of the adjacent Uinta Mountains, which form its northern border, during the latest Cretaceous through early Paleogene Laramide Orogeny. This tectonic episode was the origin of most of the paired Rocky Mountain uplifts and associated basins, including the adjacent Piceance Basin to the east (Hintze 1988). The Uinta-Piceance Basin province and general location of the GNBPA are illustrated in **Figure 3.3-1**. Structurally, rocks in the vicinity of the GNBPA dip generally north towards the center of the Basin.

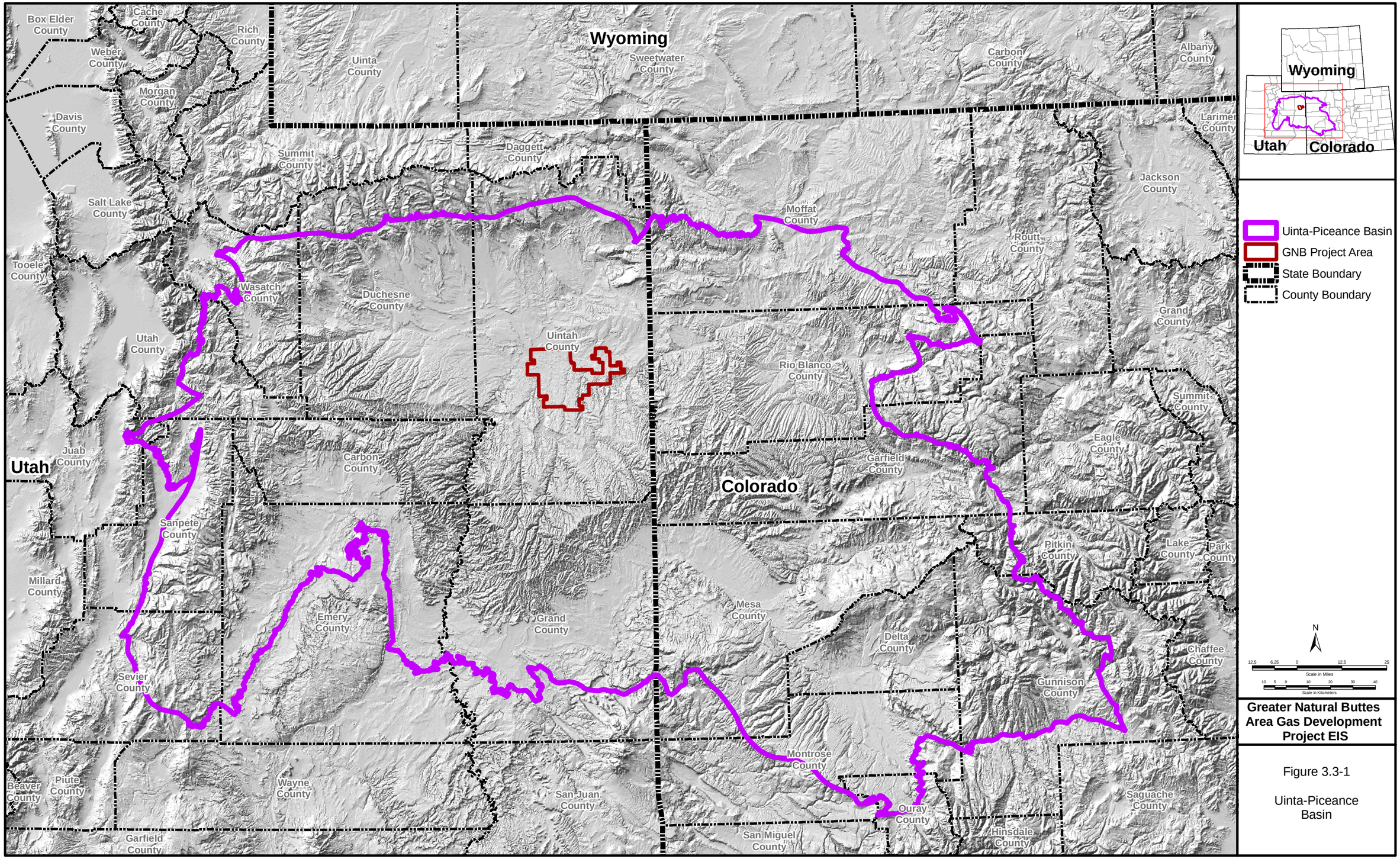
With the exception of Quaternary alluvial, colluvial, and eolian deposits found in the base of the major drainages, surface geology in the GNBPA consists almost entirely of exposures of the Middle Eocene Uinta Formation. The formation consists of fluvial sediments with some interbedded tuffs and may exceed 1,600 feet in thickness. The uppermost portion (Parachute Creek Member) of the underlying and semi-contemporaneous Middle Eocene Green River Formation is exposed in the walls of some of the deeper canyons (Rowley et al. 1985; Cashion 1973) and consists of lacustrine marlstones, siltstones, and limestones (Cashion 1982). The Uinta Formation represents encroachment of highland-derived sediments from the north onto the margins of ancient Lake Uinta, the depositional setting for the Green River rocks. Maximum thickness of the Parachute Creek Member in the area may exceed 650 feet. The two formations display complex interfingering stratigraphy (Franczyk et al. 1992; Hail 1987). A sedimentary section in excess of 20,000 feet in thickness underlies the GNBPA (Osmond 1992). A stratigraphic column for surface geology in the GNBPA is indicated in **Figure 3.3-2**.

3.3.1 Mineral Resources

3.3.1.1 Oil and Gas Resources

The Uinta Basin is a prolific producer of oil and gas. In 2006, Uintah and Duchesne counties, including the bulk of the basin, ranked first and third, respectively, for gas production and second and first for oil production in the state of Utah (UDOGM 2007). The major productive horizons include the Tertiary Green River and Wasatch formations, the Cretaceous Mesaverde Group and Dakota Sandstone Formation, the Jurassic Navajo Formation, and the Pennsylvanian Weber Formation. The USGS has delineated a number of conventional and unconventional oil and gas plays within the basin (BLM 2002a; USGS 2002), including the vicinity of the GNBPA.

The GNBPA is located within the Greater Natural Buttes gas production area, which includes portions of at least nine oil and gas fields (**Figure 1.1-2**). Production is attained from stratigraphic traps on northwest regional dips. Reservoirs include lacustrine marginal sandstones of the Green River Formation, fluvial sandstones of the Wasatch Formation, braidplain sandstones of the Mesaverde Group, and limited production from other formations. Oil production, typically exhibiting rapid decline, has been obtained from fewer than 100 wells located mainly in the northern, downdip portions of the area. A rapid development phase in the area followed completion of the Natural Buttes field discovery well in 1952 (Osmond 1992). The GNBPA includes portions of Bitter Creek, Buck Canyon, Devils Playground, Love, and Natural Buttes fields. As of October 2007, there are 1,562 productive (producing or shut-in awaiting pipeline connection) wells within the GNBPA. Almost all (96 percent) have been assigned to the Natural Buttes Field. The GNBPA includes approximately 50 percent of all of the productive wells (3,018) assigned by UDOGM to the Natural Buttes Field as of October 2007.



Greater Natural Buttes Area Gas Development Project EIS

Figure 3.3-1

Uinta-Piceance Basin

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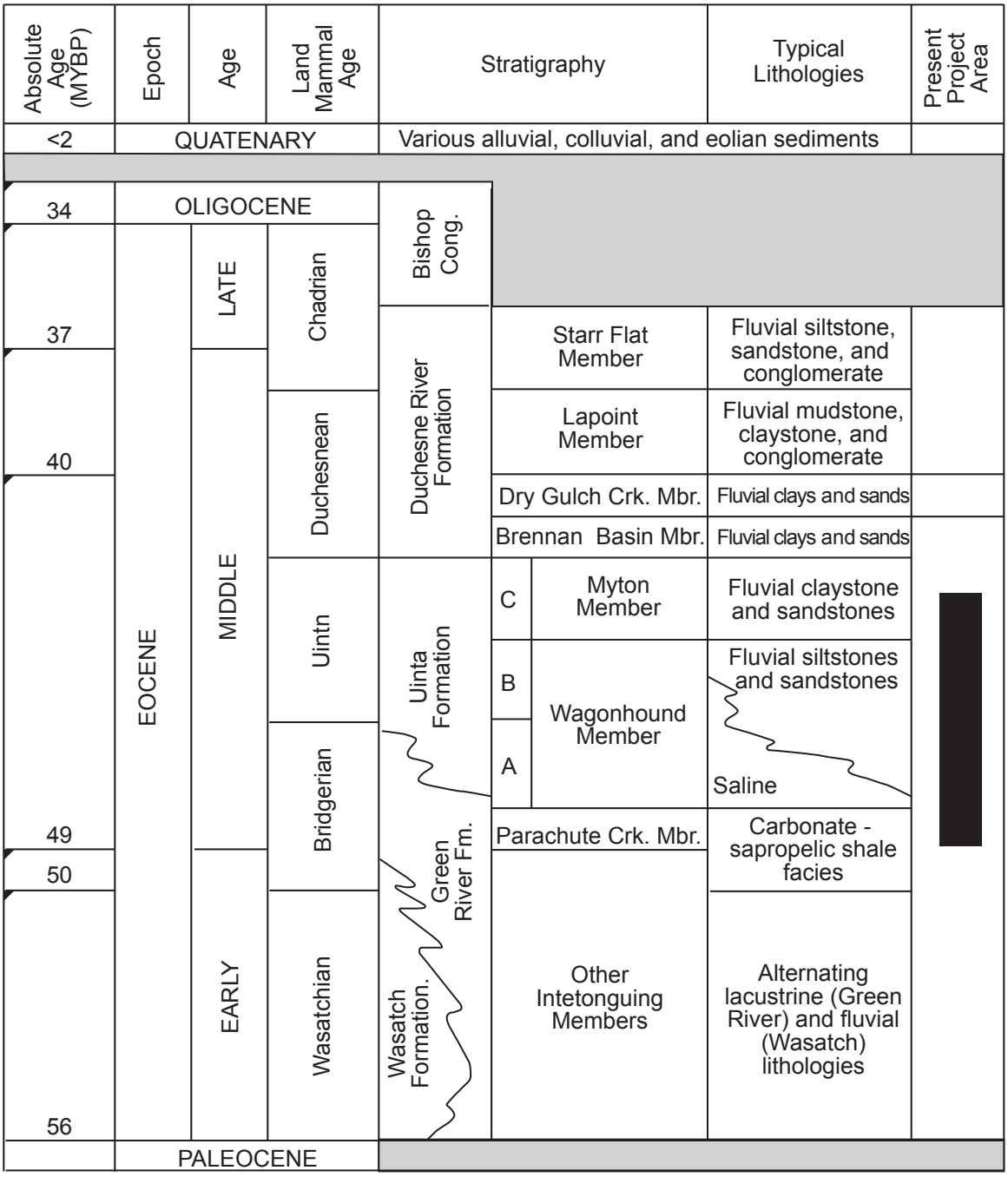

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.3-2

Surface Geology Stratigraphic Column

The accuracy of UDOGM oil and gas production records prior to 1984 is limited. Production within the GNBPA from 1984 through 2006 is summarized in **Table 3.3-1**. Natural Buttes Field cumulative production since 1984 is more than 1,272 billion cubic feet (Bcf), with approximately 61 percent of field production (774 Bcf) derived from the GNBPA. An additional 74 Bcf of production has been reported between Natural Buttes field discovery and 1982 (Clem 1985). Since 1984, the Natural Buttes Field generally has been the second most productive gas field in Utah, moving into first place in 2005. Gas production has been consistently increasing since 1997, as illustrated in **Figure 3.3-3**. In 2006, Natural Buttes Field accounted for 45.5 percent of total Utah gas production (UDOGM 2007).

Table 3.3-1 Cumulative Production in the GNBPA by Producing Zone 1984 – 2006

Producing Zone	Wells	Oil (Bbl)	Oil (% Total)	Gas (Mcf)	Gas (% Total)
Blackhawk	1	1,816	0.1	529,982	0.1
Castlegate	2	15,346	0.5	3,251,354	0.4
Dakota	2	1,502	0.0	169,121	0.0
Green River	49	887,610	29.0	27,644,643	3.6
Green River – Wasatch	3	69,945	2.3	1,377,790	0.2
Jurassic-Cretaceous	2	411	0.0	65,916	0.0
Mancos	3	4,076	0.1	951,281	0.1
Mesaverde-Mancos	1	3,428	0.1	320,379	0.0
Mesaverde	128	295,831	9.7	46,028,888	5.9
Wasatch-Mesaverde	449	756,655	24.8	174,775,738	22.6
Wasatch	707	763,190	25.0	489,176,592	63.2
Unidentified	120	256,493	8.4	30,051,049	3.9
GRAND TOTAL	**1,467**	**3,056,303**		**774,342,733**	

Source: UDOGM 2007.

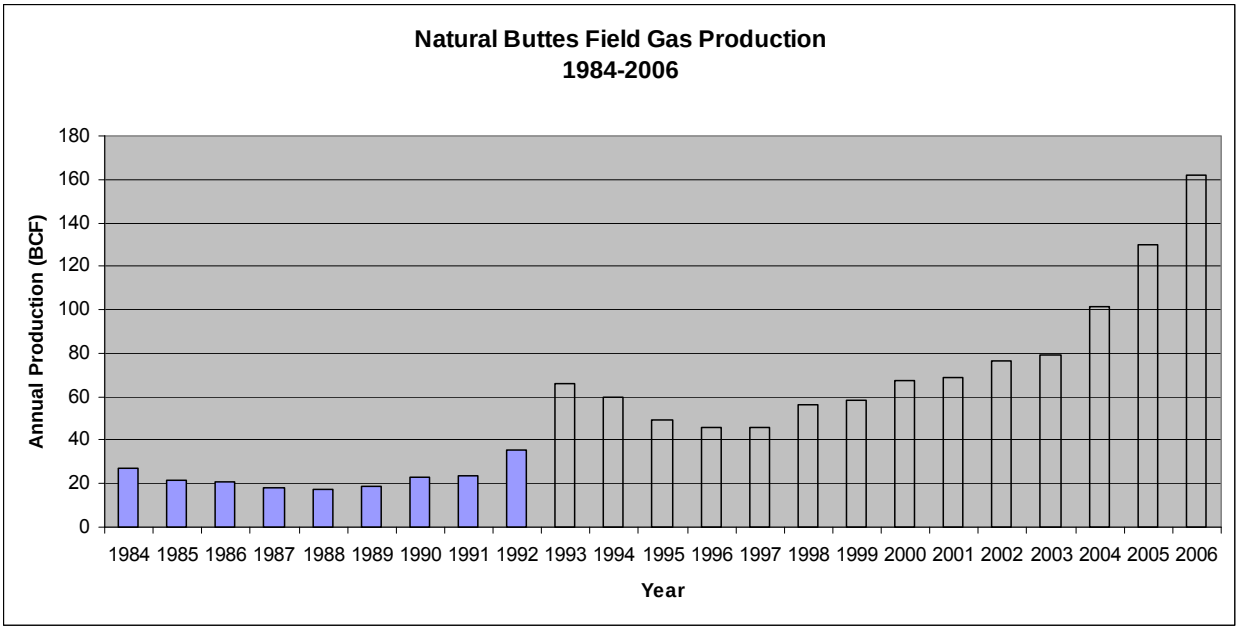

Figure 3.3-3 Natural Buttes Gas Production 1984 to 2006

The Wasatch Formation represents the principal producing zone, with more than 85 percent of total gas production being achieved from the Wasatch alone or from dual completions in the Wasatch and Mesaverde. Less than 10 percent of total gas production is solely from either the Green River or Mesaverde rocks. Stratigraphically, the deepest production has been non-commercial gas from the Lower Cretaceous Dakota Formation.

Green River Formation gas reservoir sandstones are up to 30 feet thick with porosities up to 18 percent. Average initial daily production rates are approximately 2,200 Mcf of dry (small volumes of associated natural gas liquids) gas. Average heat content of the gas is approximately 1,025 British thermal units (Btu) per standard cubic foot (scf). Both the Wasatch and Mesaverde productive sandstones are classified as "tight" sands, with average permeabilities of less than 0.1 millidarcy. Maximum porosities are 18 percent with average porosity of 10 to 14 percent for the Wasatch and 8 to 12 percent for the Mesaverde reservoirs. Wasatch productive sandstones are up to 40 feet thick. Average initial daily production rates are approximately 1,600 Mcf for the Wasatch and approximately 1,100 Mcf for the Mesaverde reservoirs. Wasatch and Mesaverde reservoir gases have slightly higher associated liquid contents than the Green River gas and heating values of 1,048 to 1,179 Btu/scf. Mesaverde reservoirs are tighter than those in the Wasatch and Green River formations and typically are slightly overpressured (Osmond 1992).

Within the GNBPA, there are 1,736 current or formerly gas-productive wells, including 1,562 producing or shut-in. Approximately 11 percent (194 wells) have achieved cumulative gas production in excess of 1 Bcf/well and three percent (51 wells) have produced more than 2 Bcf/well. As of October 2007, 789 locations were in the process of being drilled or had approved APDs.

3.3.1.2 Other Mineral Resources

Oil shale

Approximately the southern 60 percent of the GNBPA is underlain by marlstone of the Green River Formation containing the organic substance kerogen at depths of less than 2,000 feet. These "oil shales" may be processed in various ways to produce oil in quantities exceeding 15 gallons per ton of source rock. The highest quality resource is found in the lower portion of the Parachute Creek Member of the formation. Rich oil shale horizons are present over much of the depositional basin occupied by the Green River Formation and the GNBPA has the potential for oil yields of 60,000 to 90,000 bbls/acre from these rocks and large portions of the GNBPA have been designated Known Oil Shale Leasing Areas (KOSLA), indicating areas with inferred high potential for development (BLM 2002a). Intermittent attempts to commercially exploit oil shales have occurred for decades during times of high oil prices. The 2006 issuance of federal oil shale research leases by the BLM in the Piceance Basin and development of new extraction technologies indicate the potential for future exploitation of oil shale in the vicinity of the GNBPA (BLM 2006d). As of October 2007, there were no active federal oil shale leases within the GNBPA (BLM 2007a), but according to USITLA, approximately 38,000 acres of state lands were actively leased.

Gilsonite

Gilsonite is the American Gilsonite Company's trademarked name for the mineral uintaite or uintahite. Gilsonite is a black hydrocarbon resin similar to coal or asphalt in appearance and is not known to occur in commercial quantities outside the Uinta Basin. The mineral's chemical properties make it useful in the production of dark-colored printing inks and paints, oil well drilling muds and cements, asphalt modifiers, and various chemical products (BLM 2002a).

The Greater Natural Buttes gas production area coincides with concentrated gilsonite-bearing veins. The veins are vertical, vary from a few inches to up to 30 feet wide, and extend in a west-northwesterly direction for distances of up to 12 miles. The veins have been mapped in the Uinta and Green River formations as emplacements into fractures, which do not exhibit lateral displacement (Osmond 1992). The origin of the gilsonite is believed to be the oil shale-rich portions of the Green River Formation. During times of maximum burial, hydrocarbon generation and fluid expulsion in the oil shales is believed to have led to forceful

emplacement of bitumen into the vein fractures (Monson and Parnell 1992). According to the UGS database, portions of at least 55 of these veins cross the GNBPA.

All of Utah's gilsonite production occurs from four mines located near the town of Bonanza that are owned by American Gilsonite Company, Ziegler Chemical and Minerals Company, and Lexco, Inc. The mines are situated immediately outside of or within the GNBPA. Lexco's inactive ITM mine and the active Cottonwood mine are located in the southwest portion of the GNBPA (Bon and Wakefield 2008, 2006). Production of gilsonite in 2005 from these mines was estimated to be 73,000 metric tons (Bon and Krahulec 2006). As of October 2007, there were 2 authorized federal gilsonite leases comprising 435 acres, 1 active state lease comprising 160 acres, and 9 authorized or pending prospect permits comprising more than 6,000 acres located within the GNBPA (BLM 2007a).

Mineral Materials

Sand and gravel deposits on BLM-administered surface may be sold under a contract basis or disposed of for free in certain circumstances, although no active permits are located within the GNBPA (BLM 2002a). There are no currently active or historical state permits within the GNBPA (USITLA 2006).

Locatable minerals

The Tokay-Blanca uranium occurrence is located in the Uinta Formation within the GNBPA (Doelling and Bon 1990). No active locatable minerals extraction is occurring within the GNBPA (BLM 2002a) and there are no currently active mining claims (BLM 2007a).

3.4 Land Use

The study area for land use is the GNBPA. Zoning in the GNBPA is for mining and grazing, while the primary land uses are mineral extraction, agriculture, livestock grazing, and recreation. There is very little cultivated cropland in the area. Cropland is mostly hay and alfalfa near the White River. A large portion of the GNBPA has a shrub scrub land cover that is conducive to grazing, as detailed in **Figure 3.4-1**. Also, the majority of the recreational activities take place on the White River in the form of boating and fishing.

As shown in **Figure 3.4-2** and summarized in **Table 2.1-1** in Chapter 2.0, the BLM is the primary landowner within the GNBPA, with state, Tribal, and private lands also present. Private lands and State Sovereign Lands (associated with the Green River in the northwestern part of the study area) make up less than 2 percent of the total land ownership in the GNBPA. State Sovereign Lands in Utah include the beds of navigable waters on Tribal Land. All uses on, beneath, or above the beds of navigable lakes and streams are regulated for the protection of navigation, fish and wildlife habitat, aquatic beauty, public recreation, and water quality. USITLA manages lands granted to Utah by Congress to support state schools and other institutions. USITLA-administered lands make up slightly more than 20 percent of landownership.

3.4.1 White River Special Recreation Management Area

The White River SRMA totals 2,831 acres, of which 632 acres are located within the boundary of the GNBPA (**Figure 3.4-3**). As defined in the Vernal RMP (BLM 2008b), a SRMA is a public lands unit identified in land use plans to direct recreation funding and personnel to fulfill commitments made to provide specific, structured recreation opportunities. Recreational activities identified for the White River SRMA include, but are not limited to, canoeing, rafting, primitive camping, and hiking.

3.4.1.1 Areas of Special Designation

Other than the BLM White River natural area (discussed in detail under Wilderness Characteristics), there are no other areas of special designation (also including designated wilderness or wilderness study areas) contained either wholly or partially within the GNBPA (**Figure 3.4-3**). The areas of special designation closest to the GNBPA include the Ouray National Wildlife Refuge (0.4 miles), Fantasy Canyon SRMA (1.4 miles), a wild and scenic suitable segment of the Green River (1.9 miles), the Lower Green River Corridor Area of Environmental Concern (ACEC) (1.9 miles), and the Pariette ACEC (2.7 miles).

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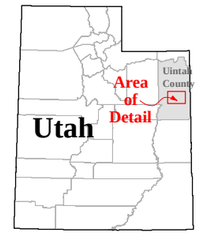
Green River
White River
Bitter Creek
Hill Creek
Willow Creek



LEGEND

- Township/Range
- EIS Project Area
- Named Streams and Rivers
- Agriculture
- Barren
- Developed
- Riparian
- Shrub/scrub

N

1 0.5 0 1 2
Scale in Miles
2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.4-1

Land Cover Types

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T10S R22E
T10S R23E
T10S R24E
T11S R20E
T11S R21E
T11S R22E
T11S R23E
T11S R24E
Green River
White River
Bitter Creek
Hill Creek
Willow Creek

Utah
Area of Detail
Uintah County

LEGEND

- Township/Range
- EIS Project Area
- Named Streams and Rivers

Land Ownership

- BLM
- Private
- State Trust Lands
- State Sovereign Lands
- Tribal Lands

N

1 0.5 0 1 2
Scale in Miles

2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.4-2

Land Ownership

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T7S R21E
T7S R22E
T7S R23E
T7S R24E
T7S R25E
OURAY NATIONAL WILDLIFE REFUGE
T4S R1E
T4S R2E
Duchesne River
T8S R20E
T8S R21E
T8S R22E
T8S R23E
T8S R24E
T8S R25E
T4S R3E
T5S R1E
T8S R19E
T5S R2E
T5S R3E
Green River
White River
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T11S R25E
Bitter Creek
Hill Creek
Willow Creek
Evacuation Creek
T12S R19E
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T12S R21E
T12S R22E
T12S R23E
T12S R24E
T12S R25E

Utah
Area of Detail
Uintah County

LEGEND

- Township/Range
- EIS Project Area
- Named Streams and Rivers
- Wild and Scenic River Suitability
- National Wildlife Refuge
- Lower Green River Corridor ACEC
- Pariette ACEC
- BLM White River Natural Area
- White River SRMA
- Fantasy Canyon SRMA

N

1 0.5 0 1 2 3
Scale in Miles

2 1.5 1 0.5 0 2 4
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.4-3

Areas of Special Designation

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3.5 Paleontology

The study area for paleontological resources is the GNBPA. Paleontological resources comprise the fossil record of past life forms, which provide data vital to interpretation of earth history.

Approximately 12 percent of the GNBPA is underlain by alluvial and eolian deposits of Quaternary age. These units occur along and form the floodplain of the White River and Bitter Creek and also are found a short distance up some tributaries to these two streams. Fossils of scientific importance have not been recovered from these units. The exposed bedrock in the GNBPA is comprised of rocks that are all of Middle Eocene age. The upper portions of the Green River Formation, of Early to Middle Eocene Age, crop out in exposures restricted to the walls of the canyons containing the White River and Bitter Creek in T10-11S, R22E, comprising approximately 4 percent of the GNBPA. All of the rest of GNBPA (approximately 84 percent) is underlain by the Uinta Formation of Middle Eocene Age (Rowley et al. 1985; Cashion 1973), which is divided into upper Myton and lower Wagonhound members. Most of the exposed formation within the GNBPA is identified as Wagonhound Member with some Myton exposures in the northern portion of the area. Both the Uinta and Green River formations are noted as sources of scientifically important vertebrate fossils. The Uinta Formation is the type formation for defining the Uintan Age division (middle Middle Eocene) of the North American Land Mammal biostratigraphic system (Rasmussen et al. 1999).

Fossils on federal lands are protected under provisions of FLPMA, as amended, 43 USC 1737(b), PL 94-579; PL 111-011, Omnibus Public Land Management Act of 2009, Subsection D, Section 6302; and 43 CFR 3802 and 3809. Paleontological resources on State of Utah lands are afforded protections under provisions of Chapter 73 of the Utah Code, and permits are required for fossil collection on both state and federal lands.

As of October 2007, the BLM has adopted the PFYC system as the standard for evaluating potential impacts to paleontological resources on public lands (BLM 2007b). The system uses a five-part classification of geologic units with respect to their potential for the production of scientifically important fossils. The evaluation scale runs from 1 (very low probability) to 5 (very high probability), based upon the unit's lithology, age, depositional setting, risk for adverse impacts, and history of producing fossils. Subclasses are assigned depending upon the degree of exposure of the unit. Approval of surface-disturbing activities affecting geologic formations rated 4 or 5 is likely to require surveys by a qualified paleontologist prior to or during construction. The BLM also may apply protective mitigations and local field offices may alter the rankings based upon site-specific knowledge. In the vicinity of the GNBPA, the BLM has evaluated the PFYC classification for both the Uinta and Green River formations as 4 or 5, indicating high to very high paleontologic potential (BLM 2008f; Murphey and Daitch 2007). A simplified map of bedrock geology and PFYC rankings within the GNBPA is indicated in **Figure 3.5-1.**

Both the BLM and the UGS maintain a database of recorded occurrences of scientifically important fossils. A file search of these records was conducted in support of this project (Alderks 2006). The inventory returned a report for each of the 254 sections within the GNBPA indicating any fossil localities in the databases, the formation and, in some cases, member, in which the fossils were discovered, and the types of fossils recovered. Of the 254 sections inventoried, 90 contain 1 to 10 recorded fossil localities (35 percent). Fifty-nine of the 90 sections (66 percent) were identified stratigraphically to the member level.

All of the recorded fossils were obtained from the Uinta Formation. Where the member was identified, 92 percent of the localities were indicated as being from the Wagonhound or Uinta B (upper Wagonhound) Member, representing the lower portion of the Uinta Formation. Five localities were recorded from the Myton Member (upper Uinta) and one contained fossils from both the Wagonhound and Myton members. No fossils were recorded from the Green River Formation.

Fossil localities are well distributed across most of those portions of the GNBPA with exposed bedrock. Myton Member representatives are restricted to the northernmost portions of the GNBPA, reflecting thicker

sections and younger horizons of preserved Uinta Formation to the north. Locality distribution also is closely correlative to the distribution of existing oil development, suggesting that many finds may have resulted from surveys done in connection with oil and gas drilling. The area of lowest density of sites is in the southern portion of the GNBPA, which also is the least drilled area. The absence of any fossils from the Green River Formation is probably a result of GNBPA exposures generally being limited to certain canyon walls where steep slopes would preclude well pad locations. It may be assumed that exposed bedrock throughout the GNBPA should be considered as having high potential for production of fossils.

The 2006 file search found that a total of 295 fossil localities have been recorded within the GNBPA (Alderks 2006). All of the reported occurrences have been from the Uinta Formation, which comprises the vast majority of the bedrock exposed within the GNBPA. No occurrences from exposures of the Green River Formation, principally limited to steeper slopes within portions of the White River and Bitter Creek canyons, have been reported to date. Fossils reported include various mammalian, reptilian, and fish species. Turtles and turtle fragments are by far the most common fossil, being reported from 87 percent of identified localities. Other common fossils include mammalian miscellaneous and limb bones, and crocodilian fragments. No avian or amphibian species have been identified (Alderks 2006). A listing of paleontological resources identified, as well as their abundance and stratigraphic occurrence, is included in **Table 3.5-1**.

Table 3.5-1 Identified Paleontological Resources of the Uinta Formation in the GNBPA

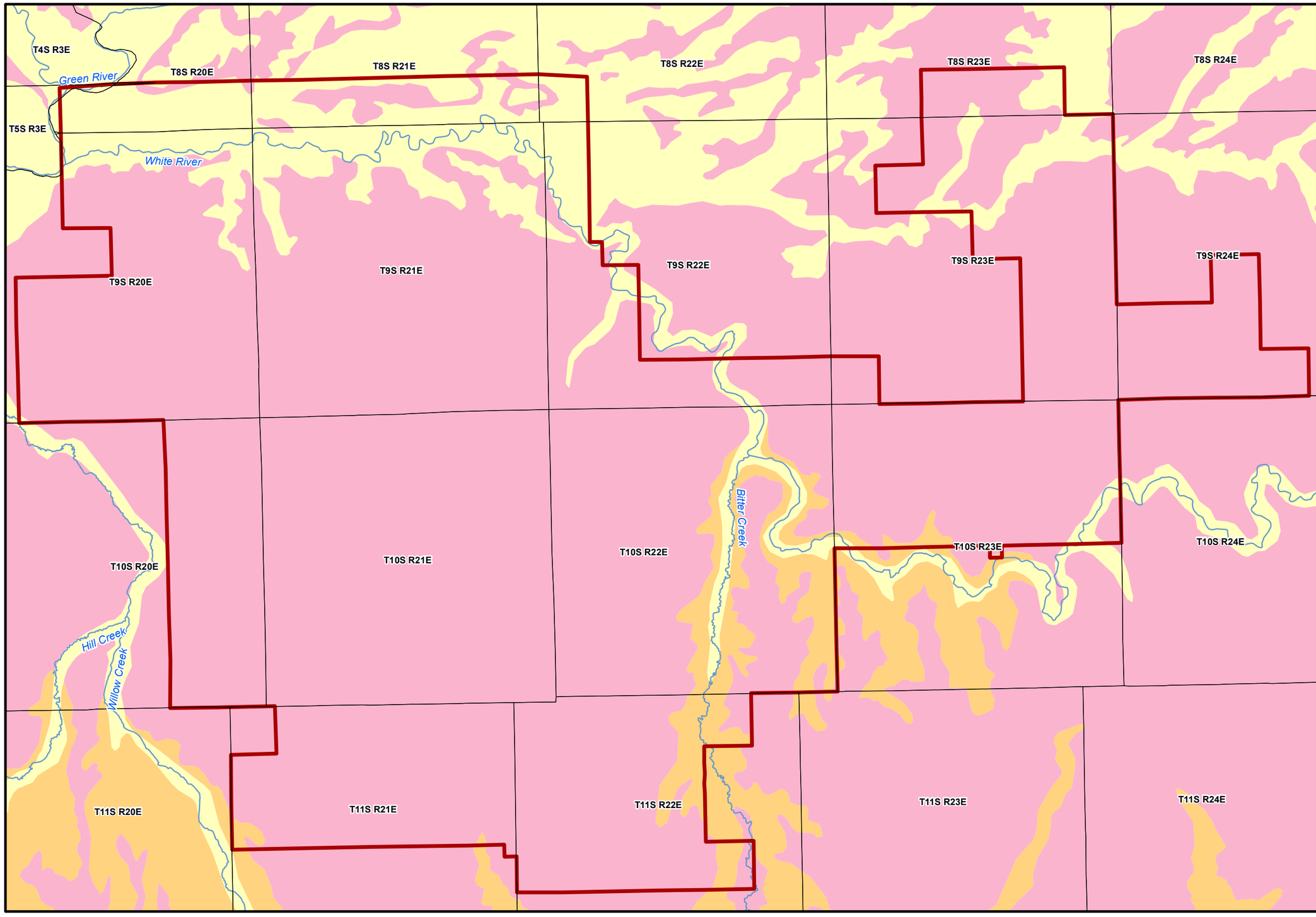
Class	Order	Family	Genus/Species/Description	Member[1]	Localities
Actinopterygii	Semionotiformes	Lepisosteidae	*Lepisosteus*	M	1
			Gar fragments and scales	W	2
Reptilia	Crocodilia		Crocodiles and crocodilian fragments	M,W	18
		Alligatoridae	*Pristichampus?*	W	1
	Squamata		Lizard fragments	W	1
	Testudines		Miscellaneous turtle fragments	M,W	78
		Baenidae	Baenid turtle fragments	W	9
			Baena	M,W	2
		Emydidae	*Echmatemys sp.*	M,W	34
			Echmatemys uintensis	W	2
		Testudinidae	Testunid turtle fragments	M,W	4
			Testudo	W	3
			Xerobates?	W	1
		Trionychidae	*Apalone sp.*	M,W	8
			Trionyx	W	7
Mammalia			Mammalian foot or limb bones	W	25
			Mammalian jaw fragments	W	9
			Mammalian miscellaneous bones	W	25
			Mammalian skull fragments	W	6
			Mammalian teeth	W	9
	Artiodactyla		Miscellaneous artiodactyl fragments	W	2
		Agriochoeridae	*Achaenodon*	W	1
			Protoreodon	M,W	4
		Dichobunidae	*Bunomeryx*	M	1
		Merycoidodontidae	Oreodont? fragments	W	1
		Protoceratidae	*Leptotragulus*	W	1
	Dinocerta		Uintathere? fragments	W	2
	Perissodactyla		Miscellaneous perissodactyl fragments	W	8
		Amynodontidae	*Amynodon?* tracks	W	2
			Titanothere fragments	W	8
			Amynodon? fragments	W	1

Table 3.5-1 Identified Paleontological Resources of the Uinta Formation in the GNBPA

Class	Order	Family	Genus/Species/Description	Member[1]	Localities
		Brontotheriidae	Miscellaneous brontothere fragments	W	8
			Dolichorinus fragments	W	4
		Equidae	Horse tracks	W	1
			Epihippus	W	1
		Hyracodontidae	*Triplopus*	W	1
	Rodentia		Miscellaneous rodent fragments	M,W	2
Other			Petrified wood fragments	W	2
			Stromatolites	W	1

[1] M indicates Myton Member, W indicates Wagonhound Member.

Source: Alderks 2006; Gunnell and Bartells 1999.



Greater Natural Buttes Area Gas Development Project EIS

Figure 3.5-1

Paleological Sensitivity

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3.6 Range Resources

The study area for range resources is defined as the GNBPA. The following section presents range management activities per allotment and water-related range improvements within the GNBPA.

The GNBPA is characterized as a patchwork of the BLM, State of Utah, Ute Tribe, and private surface ownership encompassing 8 BLM grazing allotments and 4 Ute Tribe grazing allotments. Implementation of the proposed project would result in the expansion of existing operations, thus disturbing areas currently being grazed.

Table 3.6-1 provides a summary of each BLM and Ute Tribe grazing allotment within the GNBPA, including acreage calculations, current livestock numbers, and permitted use in AUMs. **Figure 3.6-1** illustrates the BLM and Ute Tribe grazing allotments within the GNBPA.

In the GNBPA, the dominant livestock type grazed is sheep. Most of the grazing allotments are utilized from November through various times in the spring and typically are used for winter grazing, lambing, and shearing activities. The level of annual use is determined by the current climatic conditions and availability of forage resources. Lambing typically occurs from April 1 to June 1, depending on weather, forage conditions, and the condition of the livestock. Lambing occurs in covered shelters or on the open range and typically is located near water sources and areas with forage or available feed.

Different grazing rotation systems are employed on the various allotments in the GNBPA that are used for sheep grazing. Deferred rotation starts at one end of the allotment and rotates down one side and back up the other side in the first year. The following year, grazing starts at the other end of the allotment and rotates in the opposite direction. With limited deferment of spring use pastures, a different pasture is grazed each year in both the spring and fall to avoid grazing at the same time in the same area each year. The deferred rotation grazing system also consists of either alternately resting a pasture every other spring or having grazing begin and end each season in a different pasture every other year.

Grazing rotation systems include deferred rotation in the Antelope Draw allotment, a limited deferment of spring use pastures in the Coyote Wash allotment, a two-pasture deferred rotation grazing system in the Olsen Allotment Management Plan (AMP) and the Seven Sisters allotments, and grazing primarily during the non-growing season in the Southam Canyon allotment. The permits for the Southam Canyon and the White River Bottoms allotments are scheduled for renewal and will incorporate a grazing system. Permittees are required to coordinate with the BLM in advance if they plan to deviate substantially from the terms of the permit.

There currently is no pasture rotation system in place for either the Sand Wash or Thorne-Ute-Broom allotments. Both allotments are utilized sporadically, and the Sand Wash allotment is heavily fragmented, which makes it difficult to implement a pasture rotation system. Cattle often are grazed in small groups due to the high level of ongoing oil and gas activity on the allotment. The permit renewal process for these two allotments will be initiated in 2010. Each permit renewal will be analyzed through the NEPA process and will include a Rangeland Health analysis.

Range improvements predominantly consist of stock ponds, reservoirs, and guzzlers. Perennial waterbodies including the Green River, White River, and Bitter Creek flow throughout the year, providing water for livestock within the White River Bottoms and Olsen AMP grazing allotments. The intermittent reaches of Coyote Wash, Cottonwood Wash, and Sand Wash occasionally flow to provide water for livestock within the Coyote Wash, Antelope Draw, Sand Wash, and Olsen AMP grazing allotments. One spring, adjacent to Bitter Creek, also may provide water to livestock during the wet season. **Table 3.6-2** summarizes range improvements within the GNBPA. **Figure 3.6-1** illustrates range improvements within the GNBPA.

Table 3.6-1 Grazing Allotments Within the GNBPA

Grazing Allotment Name	Total Allotment Acreage[1]	Total Allotment Active AUMs[2]	Allotment Acreage within GNBPA	Projected Active AUMs within GNBPA[3]	Livestock		Grazing Period	
					Type	Number per Allotment	Begin	End
BLM[4]								
Antelope Draw[5]	61,530	3,976	2,976	192	Sheep	3,691	11/16	4/27
Coyote Wash	99,290	9,554	21,634	2,082	Sheep	5,873	11/1	5/20
Olsen AMP	134,306	12,144	36,796	3,327	Sheep	6,170	11/1	2/28
	--	--	--	--	Sheep	6,254	3/1	6/15
Sand Wash [5]	75,136	7,974	51,332	5,448	Cattle	1,191	11/30	4/30
Seven Sisters	19,285	2,348	8,608	1,048	Sheep	1,557	11/1	2/28
	--	--	--	--	Sheep	1,557	3/1	4/15
Southam Canyon	13,827	1,357	373	37	Sheep	1,315	11/1	2/28
	--	--	--	--	Sheep	1,315	3/1	4/1
Thorne-Ute Broome	5,436	400	79	6	Cattle	63	11/1	2/28
White River Bottoms	12,900	885	544	37	Cattle	106	6/1	10/15
BLM Total	**421,710**	**38,638**	**122,342**	**12,177**	**--**	**--**	**--**	**--**
BIA								
Cottonwood Wash	7,486	168	7,486	168	Cattle	33	11/1	3/31
Molly's Nipple	10,742	400	10,527	392	Cattle	80	11/1	3/31
Chapita Grove	11,330	311	2,843	78	Cattle	26	1/1	12/31
North White River	18,960	485	10,807	276	Cattle	40	1/1	12/31
BIA Total	**48,518**	**1,364**	**31,663**	**914**	**--**	**--**	**--**	**--**
Total	**470,228**	**40,002**	**154,005**	**13,091**	**--**	**--**	**--**	**--**

[1] Allotments on BIA-administered land consist primarily of Tribal land.
[2] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.
[3] Projected active AUMs were calculated based on the percentage of the allotment within the GNBPA compared to the allotment as a whole.
[4] Ownership on the BLM allotments includes USITLA, private, and BLM-managed lands. Acreage and AUMs for the BLM allotments account for all of these various landowners.
[5] Because the actual number varies over time, the total allotment active AUMs on USITLA-owned lands was calculated based on an average number of AUMs per acre.

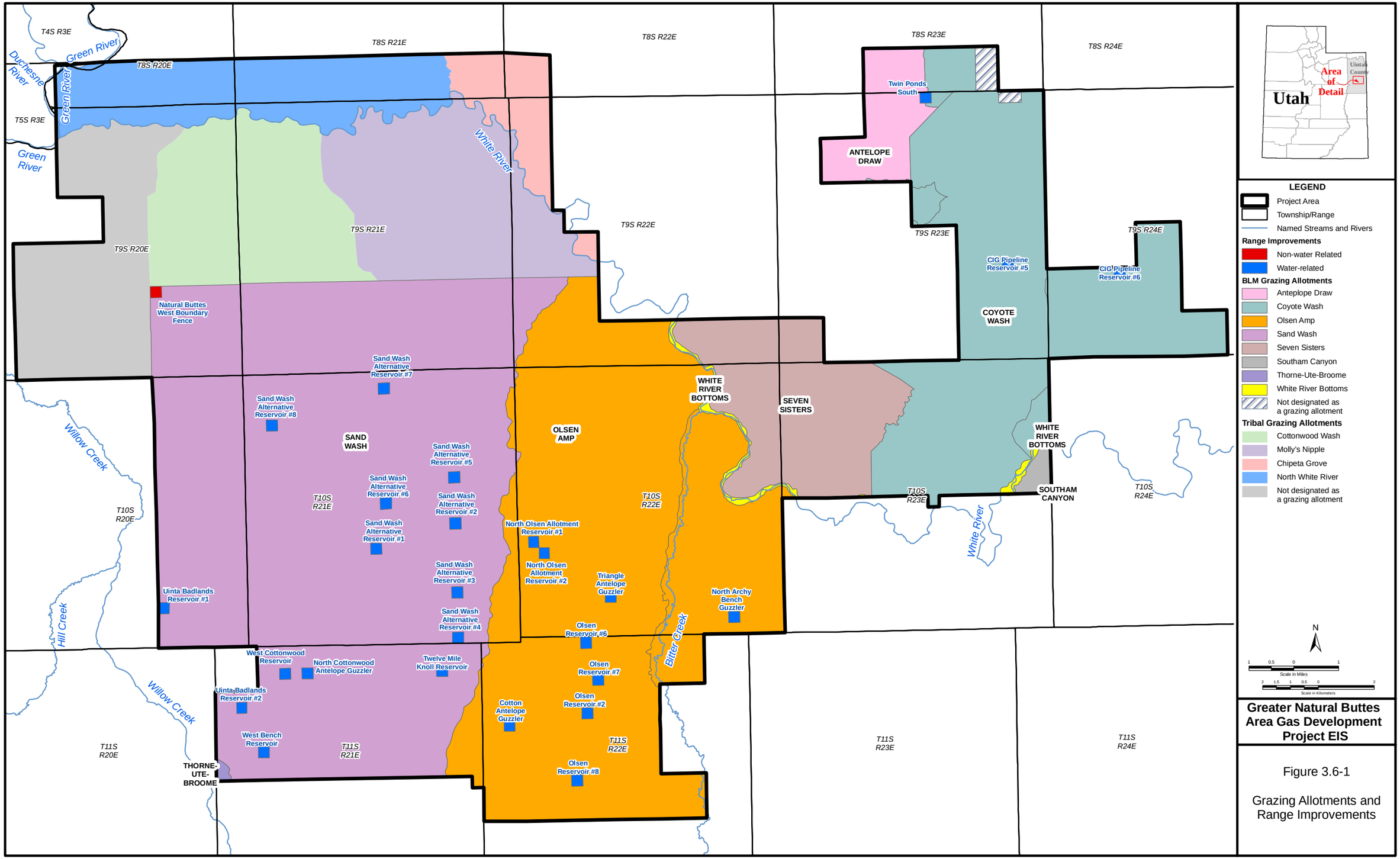

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Figure 3.6-1

Grazing Allotments and Range Improvements

Table 3.6-2 Range Improvements within the GNBPA

Grazing Allotment Name/ Range Improvement per Allotment	Legal Location				
	Meridian	Township	Range	Section	Subdivision
Coyote Wash					
Twin Ponds South	Salt Lake	009S	023E	3	NENW
Colorado Interstate Gas Pipeline Reservoir #5	Salt Lake	009S	023E	24	SWSW
CIG Pipeline Reservoir #6	Salt Lake	009S	024E	29	NWNE
Olsen AMP					
Triangle Antelope Guzzler	Salt Lake	010S	022E	33	NWNW
North Olsen Allotment Reservoir #1	Salt Lake	010S	022E	19	SESW
North Olsen Allotment Reservoir #2	Salt Lake	010S	022E	30	NWNE
North Archy Bench Guzzler	Salt Lake	010S	022E	35	NESE
Olsen Reservoir #2	Salt Lake	011S	022E	9	NESW
Olsen Reservoir #6	Salt Lake	011S	022E	4	NENW
Olsen Reservoir #7	Salt Lake	011S	022E	4	SWSE
Olsen Reservoir #8	Salt Lake	011S	022E	21	NWNW
Cotton Antelope Guzzler	Salt Lake	011S	022E	7	SWSE
Sand Wash					
West Cottonwood Reservoir	Salt Lake	011S	021E	5	NWSE
Twelve Mile Knoll Reservoir	Salt Lake	011S	021E	1	NWSW
West Bench Reservoir	Salt Lake	011S	021E	17	SWNW
Uinta Badlands Reservoir #1	Salt Lake	010S	020E	35	NWNW
Uinta Badlands Reservoir #2	Salt Lake	011S	021E	7	SWNE
Sand Wash Alternative Reservoir #1	Salt Lake	010S	021E	21	SESE
Sand Wash Alternative Reservoir #2	Salt Lake	010S	021E	23	SWNE
Sand Wash Alternative Reservoir #3	Salt Lake	010S	021E	26	SWSE
Sand Wash Alternative Reservoir #4	Salt Lake	010S	021E	35	SWSE
Sand Wash Alternative Reservoir #5	Salt Lake	010S	021E	14	SWNE
Sand Wash Alternative Reservoir #6	Salt Lake	010S	021E	15	SWSW
Sand Wash Alternative Reservoir #7	Salt Lake	010S	021E	3	SWNW
Sand Wash Alternative Reservoir #8	Salt Lake	010S	021E	7	NWNE
North Cottonwood Antelope Guzzler	Salt Lake	011S	021E	4	NWSW
Natural Buttes West Boundary Fence	Salt Lake	009S	020E	26	NWNW

3.7 Recreation

The study area for recreation is the GNBPA and adjacent White River corridor. The area in and around the GNBPA typically is used for hunting, fishing, rafting, off-highway vehicle (OHV) use, and hiking. **Figure 3.7-1** shows recreation areas near the GNBPA. Data for the number of hikers, hunters, and other recreational users in the study area, with the exception of rafting data, is difficult to collect reliably due to the dispersed nature of recreational activities. Therefore, it has not been included in this analysis. A November 2001 telephone survey of the Uinta Basin area, sponsored by the Institute of Outdoor Recreation and Tourism, revealed that hiking was the most popular recreational activity (Burr et al. 2001). The survey also indicated that OHV use and rafting are popular recreation activities in the project vicinity, as is indicated by the approximately 2,000 people who visit the White River from the Bonanza Bridge to the Enron take-out each year. Within the GNBPA, 119,899 acres of BLM-managed and state owned land are open to limited OHV use; 1,415 acres are closed to OHV use; and the remainder is undesignated.

The GNBPA is located within two game management units: the South Slope unit generally found north of the White River, and the Book Cliffs unit found to the south of the White River in the GNBPA (**Figure 3.7-1**). Hunting is allowed for mule deer and elk, and to a much lesser extent pronghorn and moose. **Tables 3.7-1** and **3.7-2** show hunting statistics from 2001 through 2006 for mule deer and elk, respectively. The majority of big game hunting within the South Slope game management unit takes place north of the GNBPA in higher forested terrain, while within the Book Cliffs game management unit, the majority is in the southern portion, well south of the GNBPA. Big game hunting season is typically from mid-August through early November.

Table 3.7-1 Mule Deer Hunting Statistics

Game Management Unit / Year	Total Mule Deer Harvest	Hunters Afield	Mean Days Hunted
South Slope			
2001	2,538	6,771	4.4
2002	2,367	6,812	5.0
2003	1,821	5,618	4.6
2004	2,630	6,372	4.9
2005	2,047	6,020	5.7
2006	2,616	6,336	5.6
Book Cliffs			
2001	423	530	4.2
2002	413	466	4.2
2003	357	422	4.9
2004	391	442	4.0
2005	412	471	4.6
2006	463	515	4.1

Source: UDWR 2007a, 2006a, 2005.

Table 3.7-2 Elk Hunting Statistics

Game Management Unit / Year	Total Elk Harvest	Hunters Afield	Mean Days Hunted
South Slope			
2001	1,438	7,172	6.2
2002	1,450	7,649	6.4
2003	1,365	7,182	6.2
2004	1,370	7,316	6.1
2005	975	6,585	6.0
2006	1,341	7,100	5.9
Book Cliffs			
2001	309	388	6.0
2002	277	388	7.3
2003	353	534	4.7
2004	167	230	4.4
2005	157	224	4.2
2006	208	270	4.5

Source: UDWR 2007a, 2006a, 2005.

The portion of the White River through the GNBPA offers canoe-camping and kayaking for a variety of experience levels (BLM 2007c). The BLM does not require a permit for boating on the White River; however, a permit is required by the Ute Tribe to park and access the White River and another is required for takeout on Tribal Lands. Recreational use of the river is typically busiest from mid-May to mid-June, followed by summer and fall. A special recreation permit has been obtained by a company for use on the White River, but it rarely is utilized.

Special Recreation Management Areas

As shown on **Figure 3.7-1**, the approved Vernal RMP designated one SRMA that falls partially within the GNBPA boundary. The White River SRMA intercepts the southeast portion of the GNBPA. An integrated activity plan has been developed for this SRMA, which provides for the following uses: canoeing, rafting, primitive camping, and hiking. This would not exclude other recreational opportunities (BLM 2008b).

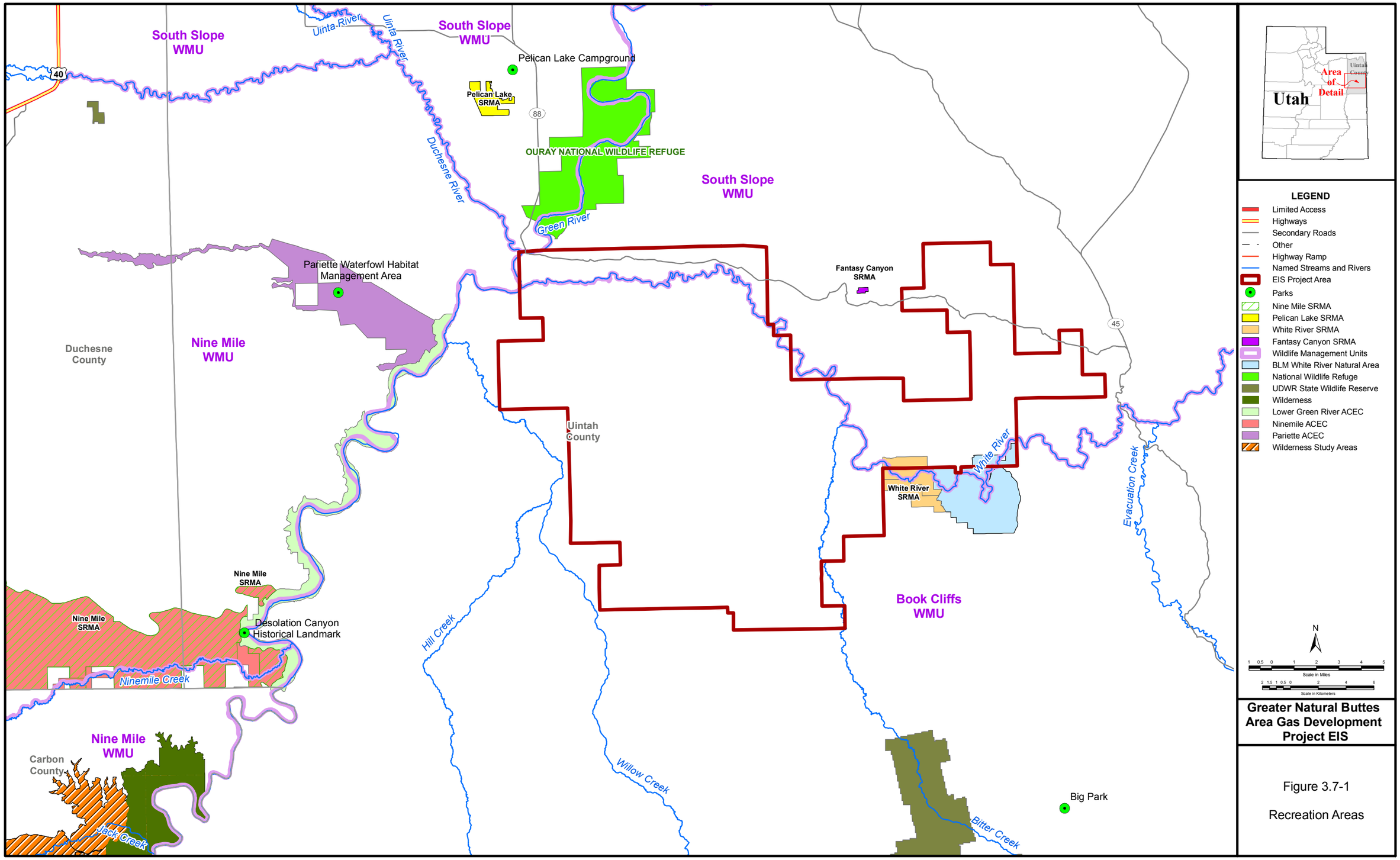

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Figure 3.7-1

Recreation Areas

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3.8 Socioeconomics and Environmental Justice

3.8.1 Study Area for Socioeconomics

The study area for socioeconomics includes Uintah and Duchesne counties. The GNBPA is located in Uintah County, Utah. The counties share a common boundary and are linked by a transportation network that integrates local resources. The two principal communities are Vernal (Uintah County) and Roosevelt (Duchesne County), which host many firms and a labor force that serves the oil and gas industry of the Uinta Basin. Many residents live in nearby communities and in the unincorporated areas of each county. This study area was defined to encompass the geographic area capturing the majority of the project's anticipated effects to the economy, population, housing, facilities and services, and fiscal conditions at a local level.

3.8.2 Background on the Role of Oil and Gas Development in the Region

The Uinta Basin is the historical center of oil and gas production in the state of Utah. More than two-thirds of statewide annual oil and gas production in Utah comes from the Uinta Basin and oil and gas development has been a major force driving the contemporary economic and social development of the Uinta Basin over the past several decades.

Although several major new discoveries have been made outside of the Uinta Basin in recent years, more than 80 percent of the new oil and gas well spuds (i.e., new well drilling) in Utah over the past 4 years have been in Duchesne or Uintah County (**Table 3.8-1**). In 2008, drilling was initiated on more than 950 new wells in these counties, with subsequent well completions raising the number of producing wells in the basin to 7,593; 88 percent of all producing oil and gas wells in the state (UDOGM 2009a,b,c,d). In recent years, the majority of new development activity in the basin has been for nature gas in Uintah County. However, Duchesne County leads Uintah County in terms of annual oil production.

Table 3.8-1 Oil and Gas Development Summary, 2005 to 2008

	2005	2006	2007	2008	Change
Two-county Share of All New Wells Spud in Utah	85%	88%	86%	83%	NA
Producing Wells					
Duchesne County	1,498	1,655	1,792	1,981	483
Uintah County	3,875	4,452	4,922	5,612	1,737
Two-county Share of State	85%	87%	88%	88%	95%
Natural Gas Produced (Mcf)					
Duchesne County	20,089,535	22,525,615	25,329,443	26,570,939	32.3%
Uintah County	163,586,421	203,552,421	218,464,429	272,211,226	66.7%
Two-county Share of State	59%	63%	63%	68%	NA
Barrels of Oil Produced					
Duchesne County	6,670,720	6,401,299	7,586,828	8,696,046	30.4%
Uintah County	4,365,012	4,959,425	5,411,742	6,567,834	50.5%
Two-county Share of State	66%	63%	67%	69%	NA

Source: UDOGM 2009a,b,c,d.

The mining industry in the Uinta Basin, which consists predominately of oil and gas development and production, saw the total number of jobs grow more than five-fold over the past 4 decades, from 928 in 1969 to 5,077 in 2007 (University of Utah 2009; U.S. Bureau of Economic Analysis 2009). In 2007, the mining sector

directly accounted for one of every six jobs in the Basin. The sector's economic significance becomes even greater when the indirect and induced effects are considered. Economic data for 2006 indicate that each direct job in oil and gas exploration, development, and production supports between 0.5 and 2.1 additional jobs in the regional economy through what is commonly referred to as the "multiplier effect" (Minnesota IMPLAN Group, Inc. 2008). Assuming an average of 1.3 additional jobs per direct job, the mining sector was responsible for approximately 38 percent of the region's total employment in 2007. The industry's influence extends beyond jobs into many aspect of the region's economic, fiscal, and social structure. For example, population growth and migration patterns tend to mirror the industry's expansionary and contractionary cycles, which ripple through the labor market to the housing market, the region's retail trade sector, local tax collections, and public school enrollment.

The most recent expansionary period began in 2002 when the area was one of several major centers of renewed natural gas development in the Rocky Mountains. The pace of development activity grew over time, with more than 900 new wells started in each of the past 3 years (2006, 2007, and 2008). That activity triggered sharp increases in local employment, population growth, and historically low local unemployment. Despite strong long-term demand for natural gas, the region has not been immune to the effects of the recent global economic slowdown. Following a sharp increase in prices between 2005 and mid-2008, slackening demand triggered by the current economic recession resulted in a dramatic slowdown in the pace of development in the Uinta Basin. Through October 2009, the number of new oil and gas wells started in the two counties was less than half the annual numbers in the preceding 3 years.

Although production and some development activity continues, the region has seen marked changes as local unemployment rates and number of unemployed nearly tripled between December 2008 and July 2009. In Duchesne County, the number of unemployed rose from 275 to 807 with a corresponding increase in the unemployment rate from 2.6 percent to 7.3 percent. In Uintah County, the ranks of the unemployed grew from 406 to 1,408, and the unemployment rate climbed from 2.2 percent to 7.2 percent (U.S. Bureau of Labor Statistics 2009). Other evidence of the economic slowdown includes drilling rigs stacked in storage yards and the suspension of construction on partially completed new homes and commercial buildings, although progress continued on several major public infrastructure projects. Less tangible or directly observable, but nonetheless important, impacts on the economy include declining retails sales and lower occupancy rates for overnight lodging.

The remainder of this section characterizes social and economic conditions in the study area, providing the background for assessing the potential social and economic effects of the proposed project. Due to time lags and differences in reporting frequencies and schedules for much of the socioeconomic data, much of the information presented focuses on pre-recession conditions and trends. A number of significant changes associated with the economic downturn are discussed where relevant.

Although the recession has brought about changes, the historical information and perspectives provide a snapshot in time perspective that is insightful as it portrays local communities responding to growth and other forces associated with high levels of oil and natural gas development. Given the energy resources located in the Uinta Basin and long-term domestic demand for natural gas, the potential exists for heightened development conditions to be re-established, stimulating other oil and gas development projects as well. Over time, these projects could recreate many, though not all, of the pre-recession conditions. For instance, one could expect renewed population growth to once again trigger new home construction. However, without the liberalized home mortgage lending practices that characterized recent years, future housing development is likely to reflect a greater emphasis on mid-range/moderate cost housing than was occurring just prior to the recession.

3.8.3 Local Population

In 2008, Uintah County had 29,885 residents and Duchesne County had 16,861 residents (**Table 3.8-2**). Between 2000 and 2008, the resident populations of Duchesne and Uintah counties grew at compounded annual growth rates (CAGRs) of 2.0 percent and 2.1 percent, respectively. Although more rapid than the 1.0 to

1.5 percent CAGRs generally accepted as manageable, both grew considerably slower than the 2.6 percent CAGR statewide. Much of the local population growth has occurred since 2003 and is largely attributed to energy resource development.

Table 3.8-2 County Population Trends

Year	Uintah County	Duchesne County	State of Utah (millions)
2000 (Census)[1]	25,224	14,371	2.23
2001	26,049	14,646	2.29
2002	25,984	14,856	2.33
2003	26,019	14,698	2.36
2004	26,224	14,933	2.42
2005	26,883	15,237	2.49
2006	27,818	15,433	2.59
2007	28,978	16,187	2.67
2008	29,885	16,861	2.74
2000-2008 Absolute Change	+4,661	+2,490	+0.51
2000-2008 Percentage Change	+18.5%	+17.3%	+22.9%

[1] 2000 Census counts are April 1. Estimates are July 1.

Source: U.S. Census Bureau 2009a.

Some new residential development in recent years has been of an infill nature or in subdivisions within the principal cities of Vernal and Roosevelt. However, much of the new development and hence, the population growth, has occurred in the unincorporated communities and outlying areas of the two counties (**Table 3.8-3**).

Table 3.8-3 Population Growth Trends within Each County

County/Municipality	2000 Census	2006 (Estimate)	2007 (Estimate)	2008 (Estimate)	2000 – 2008 CAGR
Duchesne County	14,371	15,433	16,187	16,861	2.0%
Duchesne City	1,408	1,485	1,553	1,612	1.7%
Roosevelt City	4,299	4,613	4,852	5,025	2.0%
Balance of county	8,664	9,335	9,782	10,224	2.1%
Uintah County	25,224	27,818	28,978	29,885	2.1%
Vernal City	7,714	8,140	8,403	8,696	1.5%
Other municipalities	1,866	2,131	2,239	2,383	3.1%
Balance of county	15,644	17,547	18,806	18,806	2.3%

Source: U.S. Census Bureau 2009a.

Other municipalities in the study area and their 2008 populations include: Altamont (population 194), Myton (population 597), and Tabionia (population 163) in Duchesne County, and Ballard (population 689) and Naples (population 1,694) in Uintah County (U.S. Census Bureau 2009a). The other communities in the study area are all unincorporated.

Population in the study area is predominately white, but less so than that of the state as a whole. In 2004, American Indians represented a larger share of the population in both counties as compared to the statewide

average (**Table 3.8-4**). The proportions of Hispanic and/or Latino persons were considerably lower in both Duchesne County (4.3 percent) and in Uintah County (3.7 percent) when compared to Utah as a whole.

Table 3.8-4 Racial Demographics by Community

Community	White	Black / African American	American Indian[1]	Other and Two or More Races	Hispanic or Latino[2]
State of Utah	93.8%	1.0%	1.3%	3.9%	10.6%
Duchesne County	92.6%	0.2%	5.2%	2.1%	4.3%
Uintah County	89.3%	0.2%	9.1%	1.4%	3.7%

[1] American Indian includes other native races of North America.

[2] Persons identifying themselves as Hispanic or Latino may be of any race or combination of races.

Source: Utah Governor's Office of Planning and Budget (UGOPB) 2006.

Historically, natural increase (the net difference between local births and deaths) has been a major component of the population change dynamics in Duchesne and Uintah counties. In Duchesne and Uintah counties, natural increase between 2000 and 2006 is estimated at 1,137 and 2,064 persons, respectively (**Table 3.8-5**). Net migration, the difference between the numbers of residents who move into a county and the numbers that leave, is the other component of population change. Both counties experienced several years of net negative migration since 2000; however, both also experienced substantial net in-migration in the past 2 years, with Uintah County gaining more than 630 residents and Duchesne County gaining 349 residents through migration.

Table 3.8-5 Components of Population Change

	Uintah County			Duchesne County		
Year	Natural Increase	Net Migration	Net Change	Natural Increase	Net Migration	Net Change
2000	72	-21	51	41	-33	8
2001	313	188	501	182	5	187
2002	314	138	452	166	117	283
2003	329	-265	64	196	-158	38
2004	301	-13	288	158	-87	71
2005	376	173	549	182	188	370
2006	359	467	826	212	161	373
Total	**2,064**	**667**	**2,731**	**1,137**	**193**	**1,330**

Source: U.S. Census Bureau 2007.

The Uintah and Ouray Indian Reservation covers approximately 4 million acres of land under varied ownership in Uintah, Duchesne, and Grand counties. Tribal surface and mineral ownership covers approximately 1.2 million acres, though not entirely overlapping (Ute Indian Tribe and BIA 2006). Because of varied land ownerships, the resident population within Reservation boundaries was only 14.5 percent American Indian in 2000 (**Table 3.8-6**). Total population within the jurisdictional Reservation was 19,182 in 2000, including 2,780 persons identifying themselves as American Indian in addition to another race category.

Table 3.8-6 Resident Population on the Uintah and Ouray Reservation

	2000 Census[1]
Total Population, All Races	19,182
American Indian Population (persons of one race)	2,780
American Indian Population as Percent of Total Population	14.5%

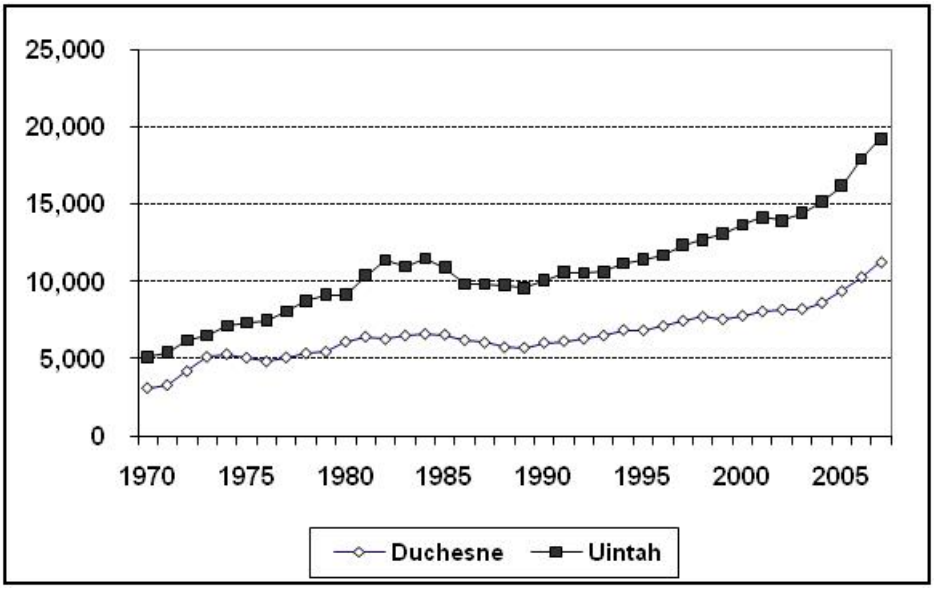
[1] 2000 Census data include population on off-reservation trust land.

Source: U.S. Census Bureau 2000a.

The Ute Tribe has a membership of 3,157, with members residing both on and off the reservation. The Ute Tribal headquarters is in Fort Duchesne. The Tribe is economically active, and its enterprises include a supermarket, gas stations, a bowling alley, livestock feedlot, Uinta River Technologies (computer data capture and management), Ute Tribal Enterprises LLC (livestock), Ute Water Systems (water and sewer for several reservation communities), and Ute Energy (exploration and development of the Tribe's mineral estate) (Ute Indian Tribe 2008). Ute Energy also participates in Chipeta Processing, a joint venture that provides gas processing and a delivery hub for the Greater Natural Buttes area. The Tribe derives substantial income from the processing revenues generated by these operations.

3.8.4 Local Economy and Labor Force

Total employment in Duchesne and Uintah counties more than tripled between 1970 and 2007 (**Figure 3.8-1**), with additional job growth realized through mid-2008. Energy resource development played a key role in local economic growth during the early 1980s. A slowdown in such development resulted in substantial economic contraction in the latter half of that decade. Total employment in Uintah County did not surpass the previous peak again until 1995. Renewed energy and mineral resource development, beginning in 2002, triggered another expansionary economic cycle in the region. More than 8,300 new jobs were added in the two counties between 2002 and 2007, a 38 percent increase.



Source: U.S. Bureau of Economic Analysis 2009.

Figure 3.8-1 Total Full and Part-time Employment, 1970 to 2007

The net long-term job growth through mid-2008 was consistent with the 3.6 percent CAGR achieved statewide. Contrary to trends in many areas, local farm employment has increased over time (**Table 3.8-7**). However, also contrary to the statewide trends that have exhibited relatively steady long-term growth, local employment growth has been more erratic. Recent economic data suggest the onset of an economic contraction in the third quarter of 2008, with a net job loss through mid-2009 of more than 3,000 jobs (U.S. Bureau of Labor Statistics 2009).

Table 3.8-7 Composition of Total Employment in the Study Area

	1990	2000	2007	Absolute Change 1990 – 2007	CAGR 1990 – 2007
Duchesne County					
Total full and part-time employment	6,016	7,766	11,216	5,200	3.7%
Wage and salary employment	4,061	5,133	7,978	3,917	4.1%
Proprietors	1,955	2,633	3,238	1,283	3.0%
Farm employment	913	992	935	22	0.1%
Uintah County					
Total full and part-time employment	10,057	13,667	19,231	9,174	3.9%
Wage and salary employment	7,410	9,999	15,108	7,698	4.3%
Proprietors	2,647	3,668	4,123	1,476	2.6%
Farm employment	811	1,000	943	132	0.9%
State of Utah (thousands)					
Total full and part-time employment	944.33	1,387.85	1,637.91	693.58	3.3%
Wage and salary employment	778.16	1,134.76	1,316.89	538.73	3.1%
Proprietors employment	166.17	253.09	357.0	190.83	4.6%
Farm employment	19.15	20.38	18.90	-0.25	-0.1%

Source: U.S. Bureau of Economic Analysis 2009.

As is common throughout the nation, non-farm wage and salary employment accounts for the majority of employment and most of the changes in the number of jobs in Duchesne and Uintah counties. The number of proprietors in the regional economy has increased substantially as well, with proprietors accounting for nearly one of every four jobs in the study area (**Table 3.8-7**). However, many of the proprietorships are part-time or incidental/casual type businesses, rather than primary, full-time enterprises.

The distribution of jobs, by major industrial sector in 2007, is described in **Table 3.8-8**. At that time, which corresponded to an expansionary period for the oil and gas industry, the mining industry (which includes the oil and gas industry) had a 20.3 percent share of total employment in Uintah County. Local government has the single largest share of employment in Duchesne County. For more information regarding the role of the oil and gas industry in the region's economy see *The Structure and Economic Impact of Utah's Oil and Gas Exploration and Production Industry, Phase I – The Uintah Basin* (University of Utah 2007).

Table 3.8-8 Non-Farm Wage and Salary Employment by Major Industry, 2007

Industry	Duchesne County	Uintah County	State of Utah
Agricultural Services, Forestry, Fishing and Hunting	1.2%	0.4%	0.2%
Mining	13.2%	20.3%	0.8%
Utilities	0.5%	0.8%	0.3%

Table 3.8-8 Non-Farm Wage and Salary Employment by Major Industry, 2007

Industry	Duchesne County	Uintah County	State of Utah
Construction	11.5%	8.5%	8.5%
Manufacturing	2.9%	2.0%	8.2%
Wholesale Trade	2.0%	3.8%	3.3%
Retail Trade	10.8%	11.6%	11.4%
Transportation and Warehousing	7.6%	5.5%	3.4%
Information	2.0%	N/A	2.1%
Finance and Insurance	2.3%	2.9%	5.7%
Real Estate and Rental and Leasing	4.1%	4.2%	5.2%
Professional Scientific and Technical Services	2.1%	3.1%	6.3%
Management of Companies and Enterprises	N/A	N/A	1.3%
Admin., Support, Waste Management, Remediation	N/A	N/A	6.1%
Education Services (private)	0.9%	0.5%	2.5%
Health Care and Social Assistance	6.3%	5.5%	7.7%
Arts, Entertainment, and Recreation	1.0%	0.7%	2.0%
Accommodation and Food Services	4.9%	5.5%	6.1%
Other Services (except Public Administration)	6.5%	5.9%	5.2%
Federal Government, civilian	0.8%	2.2%	2.1%
Military	0.7%	0.7%	1.0%
State Government, including Public Education	1.1%	0.8%	4.0%
Local Government, including Public Education	15.0%	10.9%	6.4%
Total Non-Farm Employment, not including	97.4%	95.9%	100.0%

Source: U.S. Bureau of Economic Analysis 2009.

In Uintah County, the local economy historically has been dependent on the oil and gas industry (included as part of the mining industry), and the county's relative concentration in oil and gas production has increased since the early 1990s, climbing above 60 percent of the statewide total (UDOGM 2009b,c). Mining's lower employment values in Duchesne County reflect a smaller resource base, more employment in local government and services associated with the Uintah and Ouray Reservation, and relative gains in other sectors.

In the natural gas portion of the mining industry, recent declines in wellhead natural gas prices, along with capital availability constraints, have resulted in a dramatic slowdown in new development. However, natural gas prices are expected to increase over the long term, stimulating a return to more recent levels of development activity because the oil and gas extraction industry tends to expand exploration and production and hire more workers during periods of high prices.

Energy resource development in the region, along with the economic stimulus associated with outdoor recreation and other activities has created many new jobs and decreased unemployment rates in the socioeconomics study area to record lows in 2007 and 2008. As result, local unemployment rates, which typically had been above the statewide average, were below the statewide average in 2006, 2007, and 2008, but have since surpassed the statewide average (**Table 3.8-9**).

Table 3.8-9 Labor Force and Unemployment Rates

Year	Labor Force		Unemployment Rate (Annual Average)[1]		
	Duchesne County	Uintah County	Duchesne County	Uintah County	State of Utah
2000	6,095	11,339	4.9%	4.2%	3.4%
2001	6,741	12,164	5.2%	4.4%	4.4%
2002	6,995	12,587	6.7%	6.0%	5.8%
2003	6,923	13,173	6.8%	5.8%	5.6%
2004	7,341	13,925	5.7%	5.1%	5.0%
2005	7,735	14,754	4.6%	3.9%	4.1%
2006	8,507	16,324	2.9%	2.5%	3.0%
2007	9,197	17,231	2.3%	2.2%	2.7%
2008	10,257	18,581	2.6%	2.2%	3.4%
2009 (July)	11,061	19,687	7.3%	7.2%	6.0%

[1] All unemployment rates listed as annual average values except 2009. The rate for 2009 is the rate in July.

Source: U.S. Bureau of Labor Statistics 2009.

The national economic recession in the latter part of 2008 and early 2009 affected the local labor market dramatically due to its effects on energy exploration and development. The region's labor market, which had been characterized by significant unsatisfied labor demand, had relatively few unfilled jobs. More than 3,000 jobs were lost locally and local unemployment more than tripled between December 2008 and July 2009. The higher unemployment levels reflect not only a loss of local jobs, but in-migration by individuals who lost jobs elsewhere and rising labor force participation stimulated by the economic recession.

The dynamic nature of the region's labor market during the pre-recessionary expansion is characteristic of conditions associated with energy and mineral development when rapid economic expansion absorbs available labor, lowers unemployment rates, induces labor migration, and creates competition for available labor among employers. Some of those effects were highlighted in a 2005 statewide survey that indicated a job vacancy rate of 5.2 percent in the Uinta Basin, the highest of any region surveyed. The survey tallied nearly 900 job openings at an average advertised wage of $12.20 per hour (Utah Department of Workforce Services [UDOWS] 2005). However, labor market conditions changed rapidly with the concurrent occurrence of the economic contraction in the energy industry and the broader economic recession, the effects of which include rapidly rising unemployment and higher short-term labor force participation. Absent a timely economic recovery, out migration and declining labor force participation would be expected over time, contributing to a contraction in the local labor force and setting the stage for a reoccurrence of the same pattern with the next expansionary cycle.

In northeastern Utah, which includes Duchesne and Uintah counties, tourism is an important component of the economy. According to the Utah Division of Travel Development (2004), tourism employment, including both direct tourism employment and the ripple effects of that employment, constitutes from 10 to 19 percent of total employment in the GNBPA. Recreation resources of the GNBPA are described in Section 3.7, Recreation.

Historically, per capita income for residents of Duchesne and Uintah counties has often been below the statewide average. More recently, the gaps between the statewide average and corresponding averages in the two counties narrowed (**Table 3.8-10**), due in large part to higher employment in the oil and gas industry, declining unemployment, and the effects of higher labor demand pushing up wages for other jobs. In Duchesne County, the 2007 per capita income was 111 percent of the statewide average, up from 83 percent in 2001. In Uintah County, the 2007 per capita income was 99 percent of the state average, up from 76 percent in 2001. Real, inflation-adjusted growth in per capita income from 2001 to 2007 was a strong 36 percent in Duchesne County and 35 percent in Uintah County, compared to just 3 percent statewide.

Table 3.8-10 Per Capita Personal Income

	Per Capita Income				Per Capita Income as a Percent of Statewide Income		
	2001	2005	2007	Change 2001-2007	2001	2005	2007
Duchesne County	$20,702	$25,660	$32,996	59%	83%	94%	111%
Uintah County	$18,770	$23,851	$29,534	57%	76%	88%	99%
State of Utah	$24,809	$27,321	$29,831	20%	100%	100%	100%

Source: U.S. Bureau of Economic Analysis 2009.

As is shown in **Table 3.8-11**, mining jobs are large contributors to total and per capita income in Duchesne and Uintah counties. The mining industry recorded high average monthly wages in both counties in 2006, second only to the utilities industry in Uintah County. "Arts, entertainment, and recreation" and "accommodations and food services" industries are among the lowest-wage industries in the these counties, reflecting not only lower pay scales but the fact that many of the jobs are less than full time.

Table 3.8-11 Private Non-Farm Average Monthly Wages, by Major Industry, 2006

Industry	Duchesne County	Uintah County	State of Utah
Agricultural Services, Forestry, Fishing, and Hunting	$1,506	$1,461	$1,995
Mining	$5,257	$5,366	$5,241
Utilities	$2,613	$6,894	$6,534
Construction	$2,867	$2,702	$2,959
Manufacturing	$2,826	$2,119	$3,471
Wholesale Trade	$3,645	$3,826	$4,160
Retail Trade	$1,595	$1,771	$2,029
Transportation and Warehousing (48 and 49)	$4,332	$4,586	$3,209
Information	$2,820	$2,117	$3,659
Finance and Insurance	$2,261	$2,702	$4,040
Real Estate and Rental and Leasing	$1,608	$4,714	$2,782
Professional Scientific and Technical Services	$3,104	$3,040	$4,402
Management of Companies and Enterprises	-	-	$4,880
Admin., Support, Waste Management, Remediation	$1,645	$2,100	$2,013
Education Services (private)	$299	$1,478	$2,116
Health Care and Social Assistance	$2,607	$1,934	$2,831
Arts, Entertainment and Recreation	$752	$618	$1,691
Accommodations and Food Services	$907	$838	$1,100
Other Services (except Public Admin.)	$2,168	$2,332	$2,123

Note: Some values are missing because data are withheld when necessary to protect information regarding a single or dominant establishment/employer.

Source: UDOWS 2007a.

Non-labor earnings is another dimension of regional personal income. Dividends, interest, rent, and personal transfer receipts are nearly 28 percent of total income in Duchesne County and 27 percent in Uintah County, both slightly above the 26 percent share statewide (**Table 3.8-12**). In Duchesne and Uintah counties,

non-labor income is associated with income maintenance and public assistance medical care benefits rather than with public retirement benefits or property income.

Table 3.8-12 Composition of Total Personal Income, 2005

	Duchesne County		Uintah County	
	($000)	Pct. of Total	($000)	Pct. of Total
Total Earnings by Place of Work	$ 265,687	67.5%	$ 563,146	87.0%
Less: Contributions for Government social insurance	- 31,712	- 8.1%	- 67,442	10.4%
Plus: Net Residency Adjustment	50,498	12.8%	- 21,174	-3.3%
Net Earnings by Place of Residence	$ 284,473	72.3%	$ 474,530	73.3%
Plus: Dividends, interest and rent	40,310	10.2%	71,563	11.1%
Plus: Personal Current Transfers	68,541	17.4%	100,951	15.6%
Equals: Total Personal Income	$ 393,324	100.0%	$ 647,044	100.0%

Source: U.S. Bureau of Economic Analysis 2007a.

People who commute to work also have an impact on personal income measured within a single county. In-commuters take income away from the county where jobs are located, and out-commuters bring income back to their home county. According to the 2000 Census Duchesne County had net out-commuting of 237 commuters and Uintah County had a net of 299 out-commuters (**Table 3.8-13**).

Table 3.8-13 Workforce Commuting in Duchesne and Uintah Counties, 2000

	Duchesne County	Uintah County
Persons living in county/Working outside	1,115	1,235
Persons living outside/Working in county	878	936
Net commuting out-flow	237	299
Total employed labor force living in county	5,679	11,112
Percent of resident workers out-commuting to jobs	15.5%	11.1%
Total industry jobs in county	7,766	13,667
Percent of jobs in county held by in-commuters	11.3%	6.8%

Sources: U.S. Bureau of Economic Analysis 2007b; UDOWS 2007b; U.S. Census Bureau 2003a,b.

The impact of commuting on personal income depends on the income levels of commuters; high incomes associated with commuting in one direction can offset larger numbers of commuters in the other direction whose incomes are lower. Detailed income data from 2005 show that the net effect of commuting was to add 12.8 percent to personal income in Duchesne County. The effect in Uintah County was to subtract 3.3 percent from personal income in 2005 (U.S. Bureau of Economic Analysis 2007b).

3.8.5 Specific Economic Sectors

Discussions of specific economic sectors are included because they are the subject of expressed public interest as evidenced by comments received during the scoping process. This section addresses two specific topics: grazing and recreation and the oil and gas industry. Discussion of the first two topics focuses on the economic impact of resources in these sectors that are in or near the GNBPA. The third topic discusses how local oil and gas resources fit into a regional and national context.

3.8.5.1 Grazing

Agriculture is an important segment of the regional economy, with more than 1,900 farm proprietors and employees in 2005. Collectively local farmers and ranchers had receipts of $62.6 million from sales of livestock and crops in 2005, 83 percent of which was derived from livestock sales (U.S. Bureau of Economic Analysis 2009). Like much of the west, the area has endured extended drought, one impact of which has been pressures on ranchers to trim back herd sizes due to reduced availability of feed. In 2005 more than $9.0 million of the total livestock sales by local ranchers were characterized as the value of "inventory reductions."

As in other western states, the local ranching industry relies on grazing on public lands. The GNBPA includes portions of 12 federal (BLM and BIA) grazing allotments. The federal allotments are primarily fall/winter use (November to April). Total authorized use on the 12 allotments is 40,002 AUMs. Actual use has been much less in recent years due to climatic conditions that have limited forage availability. The approximate potential value of the production in these allotments, based on average value per AUM, is presented in **Table 3.8-14**.

Table 3.8-14 Approximate Value of Annual Livestock Production from Federal Grazing Leases

AUMs[1]	Value in GNBPA
Total Active AUMs (All Allotments)	40,002
Total Projected Active AUMs within the GNBPA	13,091
Projected Active AUMs (Cattle/Sheep)	6,405 / 6,686
Potential Gross Value of Production from grazing on public lands (2006 $)[2]	$396,672

[1] An AUM represents the quantity of forage required to sustain 1 cow-calf pair or 5 sheep for 1 month.
[2] Gross value of production based on $36.91 / AUM for cattle and $ 23.97 / AUM for sheep (2006 $).

Sources: USDA 2007; BLM 2008c.

The estimates in **Table 3.8-14** are based on generalizations about the productivity of the grazing allotments found within the GNBPA. Circumstances that affect the actual gross value of production include weather, stocking rates, livestock prices, and forage availability. In addition, grazing on a particular allotment may serve a disproportionate role on permittee production if restrictions in use occur and the permittee "depends" on the allotment and cannot find substitute forage at the same cost, in a feasible location, or in the proper seasonal sequence (Godfrey and Bagley 1994).

3.8.5.2 Outdoor Recreation

Beneficial economic impacts from visitor expenditures occur in the local economy where people stop and stay while visiting an attraction. The routes that people take to access attractions determine where expenditures occur.

The Utah Office of Tourism calculates very general spending estimates of visitors. The office has estimated the average daily expenditures per person per day in southern Utah at $87 (adjusted to 2006$) (Utah Office of Tourism 2002). Such visitor expenditures create a beneficial economic impact in a county if the expenditures are from non-residents of the county; however, there are no recent estimates of overall tourism visitation in Duchesne and Uintah counties.

Local outdoor recreation opportunities and attractions include the Pariette Wetlands, Fantasy Canyon, scenic byways, camping, hiking, and rafting on portions of the White River east of the study area. General public recreation use in the area is relatively light, although approximately 2,000 rafters use the nearby stretches of the White River annually and several youth -oriented outdoor recreation programs use public lands in the area to conduct their programs. The BLM Vernal Field Office has issued 23 guide permits providing for recreation use of public lands, though the areas of permitted use are not confined exclusively to the GNBPA. Public lands

in the area also are part of an important upland game hunting area managed by the UDWR (BLM 2008c). The area also hosts some visitors associated with rafting on the Green River, downstream from the study area. High season use from May 15 to August 15 is limited to 6 launches per day of up to 25 people per launch.

Hunting and fishing, much of which is related to public lands, also is an important source of economic stimulus for the local economy, particularly for local motels, restaurants, sporting goods dealers and outfitters. According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 20 percent of all Utahans hunted or fished in 2006, and 32 percent participated in some form of wildlife watching. Average annual participation among Utah sportsmen was estimated at 10.1 days for fishing, 8.7 days for hunting, and 21.5 days for wildlife watching and the estimated average daily expenditures associated with this activity were $100 for fishing, $203 for hunting, and $41 for wildlife watching (USFWS 2007a). The UDWR reported sales of 5,175 hunting licenses, 7,291 fishing licenses, and 1,956 combination hunting and fishing licenses to residents of Duchesne and Uintah counties in 2006 (Johnson 2007).

3.8.5.3 Non-market/Non-use Values

Beyond the recreation benefits to individual users of an area, residents of and visitors to the area derive an array of economic, environmental, social well-being/quality of life, and other benefits from the area's public and private lands. Many of these benefits to individuals, businesses, and other entities come directly or indirectly from activities and uses supported by the lands. Activities such as grazing, energy resource production and consumption, and commercial outfitting occur on public land and involve market transactions that can be estimated and reported. In many cases, the beneficiaries are local; however, some beneficiaries may be located far away from the use or activity.

Many services derived from public lands are not marketed or directly measureable, yet they provide satisfaction and utility to society even if no money changes hands. These are referred to as non-market benefits. Examples of such services include open space, establishment of wilderness, preservation of critical wildlife habitat, protection of sensitive and endangered species, and the protection of historical trails and vistas. Even though these non-market benefits are not represented in market transactions, individuals and society as a whole place a value on them. There is a body of literature that argues that protecting lands with certain features and attributes from development may indirectly provide benefits such as enhanced property values for nearby private property or enhanced local community and economic development efforts.

Individuals also may derive benefits from non-use, which involves benefits associated with the preservation of environmental values not directly experienced. Three categories of such non-use values are commonly defined: bequest, existence, and option. Bequest values are associated with the knowledge that something will be preserved for the potential use or enjoyment of future generations. The existence value is the value one derives simply from knowing that something exists, irrespective of any plans to experience/use it personally. The third category of non-use value, the option value, is the value of simply maintaining the option to directly experience or be involved in an activity, irrespective of any plan to do so in the foreseeable future. As with some of the use benefits, non-use benefits apply both to local residents and to those located elsewhere.

Economists have developed valuation techniques to quantify use and non-use benefits in dollar terms. Implementing those techniques is time consuming, complex, and costly. As a result, non-market valuation techniques generally are applied on lands and environmental services that are more ecologically or culturally unique or sensitive, scenic, undeveloped, remote, and/or provide high quality recreation opportunities. Valuation of potential non-market attributes usually is not as appropriate for lands that have already been affected by development, such as those in this assessment area. Nevertheless, public land managers routinely consider qualitative aspects of non-market values in their land use decisions through their review of public comments submitted by agencies, organizations, and members of the general public who value scenic, historic, environmental, and wilderness aspects of public lands.

3.8.5.4 Regional and National Natural Gas Industry Trends

Comments received during the scoping process expressed concern for Utah's role and that of areas near the GNBPA in the national energy strategy.

The U.S. Department of Energy (USDOE) Energy Information Administration (EIA) published a forecast of domestic natural gas production (USDOE 2009a) predicting that the Rocky Mountain and Alaska regions would be the source of most of the increase in domestic natural gas production through 2030. That forecast also anticipates that much new production of onshore natural gas in the lower 48 states would come from "unconventional" resources, including coalbed methane, tight sandstones ("tight gas"), and gas shales. The EIA also anticipates construction of new pipeline capacity from the Rocky Mountains to deliver increased production to national markets.

Interest in Utah natural gas has increased because of market conditions. Utah is a net exporter of natural gas. Major pipeline corridors connect Utah and other Rocky Mountain states to the West and Midwest regions. In the West, the major natural gas markets are California and Nevada (USDOE 1998). Interest in Utah's resources also is reflected in the growing leasing interest expressed to the BLM Utah State office over the past 5 years. Recent leasing nominations have focused on areas in the Price, Richfield, Fillmore, and Cedar City field offices. Although these areas have seen less development historically than the Uinta Basin, recent exploratory drilling and geophysical testing indicates significant oil and gas potential in these areas (BLM 2006e).

Analysis of data published by the UDOWS indicates that there are 269 businesses in the GNBPA that are related to oil and gas development (**Table 3.8-15**). Uintah County hosts 191 of these establishments (71 percent of the total); Duchesne County hosts 78 businesses. Across the two counties, the 269 oil and gas development-related businesses represented 15 percent of all public and private sector establishments in 2006.

Table 3.8-15 Oil and Gas Development Related Businesses in the GNBPA, 2006

Business Sector (NAICS Code)	Duchesne County	Uintah County	Two County Total
Extraction of Crude Petroleum and Natural Gas (211111)	13	12	25
Extraction of Natural Gas Liquid (21112)	1	1	2
Drilling of Oil and Gas Wells (213111)	5	17	22
Support Activities for Oil and Gas Operations (213112)	52	132	184
Construction – Oil and Gas Pipelines and Related Facilities (237120)	2	8	10
Manufacturing – Oil and Gas Field Equipment (331132)	1	1	2
Wholesale – Industrial Equipment (423830)[1]	3	15	18
Transportation – Gas Pipelines (486210)	1	5	6
Total	78	191	269
Total Establishments – All Industries	667	1,182	1,849
Oil and Gas Related (Share of Total)	12%	16%	15%

[1] The sector includes sales of pipeline equipment.

Source: UDOWS 2007c.

3.8.6 Community Facilities and Services

Housing markets and public facilities and services are described in terms of their ability to accommodate future growth. These attributes influence the commuting and relocation choices of workers attracted by jobs created by the Proposed Action.

3.8.6.1 Housing

Housing inventoried in 2000 by the U.S. Census Bureau was predominantly detached single-family; 64 percent of housing in Duchesne County, and 73 percent of housing in Uintah County (**Table 3.8-16**). That trend has continued. Mobile and manufactured housing is fairly common and increasing in frequency. Housing units in multi-family structures are the least common housing types in both counties.

Table 3.8-16 County Housing Stock By Type, 2000

Housing Type	Duchesne County	Uintah County
Single Family	63.5%	73.2%
Duplex	1.0%	2.4%
All Other Multi-Family	8.6%	9.1%
Mobile and Manufactured	26.9%	15.3%

Source: U.S. Census Bureau 2000b.

The growth in housing supply in the region generally has kept pace with resident population growth from 2000 to 2008, with the housing supply increasing by nearly 16 percent in Duchesne County and 19 percent in Uintah County (**Tables 3.8-17** and **3.8-18**).

Table 3.8-17 Total Housing Units by County

Year	Duchesne County	Uintah County
2000	7,028	9,071
2001	7,196	9,201
2002	7,277	9,310
2003	7,384	9,416
2004	7,489	9,512
2005	7,594	9,636
2006	7,759	9,860
2007	7,937	10,301
2008	8,125	10,822
2000-08 Absolute Change	1,097	1,751
2000-08 Percent Change	15.6%	19.3%

Source: U.S. Census Bureau 2009b.

Table 3.8-18 Cumulative Building Permits for New Residential Development

	Permits Issued 2000 to 2008		
	Duchesne County	Uintah County	Combined Total
Number of Units	1,605	2,734	4,339
Average per Year	178	304	482
Percent Single Family	58%	58%	58%
Percent Manufactured/Mobile Homes	39%	20%	27%
Percent Duplexes, Condominiums, Apartments, and Other	3%	22%	15%

Source: University of Utah 2009.

An analysis of building permits issued from 2000 to 2008 indicates that nearly 60 percent more dwelling units were authorized for construction as appear in the Census Bureau's estimated housing stock. Some of the difference is attributable to units that remain under construction and will be reported in subsequent years. Other units have been canceled or construction has ceased due to factors related to the current economic downturn. Despite the differences, the dwelling unit mix is informative, showing that 58 percent of the permits in the two counties were for single family dwellings, 27 percent mobile homes or manufactured units, and 15 percent for duplexes or multi-family housing (**Table 3.8-18**). The latter represents a considerably higher share than existed in 2000; an indication of the housing demands associated with the many temporary, younger, and unaccompanied workers in the oil and gas industry. Most of the new multi-family units were located in Uintah County (University of Utah 2009).

Historically, local housing was concentrated in Roosevelt and Vernal. However, recent new housing construction has been concentrated in unincorporated parts of the counties; more than 85 percent of the permits issued in Duchesne County were for homes located in unincorporated areas, with only a slightly lower share of all permitted units located in unincorporated Uintah County.

Local housing costs have risen sharply in recent years due to strong demand and households with higher income levels. Consequently, housing affordability had been as much an issue as availability prior to the recent economic downturn. As shown in **Table 3.8-19**, the average sales price of homes sold in the Uinta Basin increased by 82 percent between 2004 and 2007, before retreating in 2008. Increases in local housing prices outpaced the statewide increases such that the local average sale price climbed from 61 percent of the statewide average in 2004 (excluding Park City) to 85 percent in 2007. Sales prices in the Uinta Basin declined faster than the statewide average during the latter part of 2008, cutting the ratio of local to statewide prices back to 78 percent.

Table 3.8-19 Homes Sales and Average Prices in the Uinta Basin

Year	Number of Sales	Average Sales Price of Homes Sold	Local Price as Percent of State Average[1]
2004	427	$115,144	61.0%
2005	544	$137,798	69.6%
2006	634	$172,132	74.5%
2007	555	$209,496	85.2%
2008	625	$187,762	78.2%

[1] Comparison to state average based on state average not including Park City.

Source: Utah Association of Realtors 2009.

The strong local demand for housing also is reflected in the increase in the number of sales, climbing from 427 in 2004 to 634 in 2006. Home sales, including both new homes and resale of previously owned homes, continued strong through the first half of 2007; abating somewhat thereafter as local demand fell sharply. Sales rebounded slightly in 2008 in terms of the number of units sold, but the average sales price was below that in 2007. Fewer units were sold in the first 6 months of 2009, as compared to 2008, but the average sales price had again climbed above $200,000 (Utah Association of Realtors 2009).

Housing availability in Uintah and Duchesne counties has improved somewhat in the wake of the national economic slowdown. The slowdown has reduced the pace of oil and gas development and increased unemployment, triggering some out-migration of workers and easing demand on housing. A search of a nationwide listing service from the National Association of Realtors found 95 residential properties in the Roosevelt area and more than 400 units in the Vernal area listed for sale. Single family homes in the Vernal area range in price from approximately $100,000 to nearly $1,000,000, with many new units listed at over $300,000 (National Association of Realtors 2009).

Natural gas development in Uintah and Duchesne counties is supported by a resident workforce plus workers who live in the area on a temporary basis while maintaining a permanent home elsewhere. The latter reside in motels, field camps, rental housing, and recreational vehicles (RVs), which can be parked at commercial campgrounds. The study area has a large, existing stock of motel rooms and RV campgrounds. This includes approximately 800 motel rooms and 500 commercial RV spaces (some year-round and some seasonal) in the vicinity of Vernal (Uintah County) and Roosevelt and Duchesne (Duchesne County) (Go-Utah.com 2007; Duchesne County Chamber of Commerce 2007; Dinosaurland Travel Board 2007).

Local motels and campgrounds also support the tourism and recreation. Growing industry use, corresponding to the rising level of drilling activity, has absorbed more motel room nights, particularly in Uintah and Duchesne counties, which sometimes limits availability. Availability is particularly an issue during the summer and during the fall hunting season. During the summer of 2007, the Vernal area was able to house all visitors by identifying available lodging at times of peak demand and arranging accommodations through regional "welcome centers" (Farmer 2007; Oviat 2007).

3.8.6.2 Water and Wastewater

The Ashley Valley Water Reclamation Facility (Uintah County) treats wastewater for an area that includes Ashley Valley and the cities of Vernal and Maeser. The facility opened in 2001 (UDEQ 2001). Some additional water and sewer system improvements are needed to serve anticipated long-term growth needs by the Ashley Valley Water and Sewer District and the City of Vernal, which jointly manage the wastewater plant with the Maeser Water and Sewer District (Natural Resources Impact Working Group 2006).

The Roosevelt municipal water system (Duchesne County), which also serves communities along the line from the water source near Neola, rations culinary water during peak summer demand. Completion of an $80 million Sand Wash Pipeline in 2008 will relieve the shortage by providing untreated water for irrigation. The Roosevelt wastewater system, at 50 percent of capacity, is nominally adequate for another 6,000 persons (Hancock 2007).

Duchesne City's water system has the capacity to handle build-out within the city limits. Water mains are being enlarged to serve large subdivisions outside the city with wholesale treated water. The city's wastewater lagoons are near capacity, needing to be dredged, but they will not be expanded because outlying subdivisions will rely on septic systems (Miller 2007).

3.8.6.3 Public Safety

The Uintah County Sheriff has a staff of 53, including 19 certified officers and 22 correctional officers. The Duchesne County Sheriff's Office has a staff of 56, including 16 road deputies and 26 correctional officers (Duchesne County 2006a).

The largest municipal police departments near the GNBPA are in Vernal and Roosevelt. The Vernal police department has 19 sworn officers (Vernal City Online 2008). Roosevelt's department has 9 officers, 5 reserve officers, 1 animal control officer, and 2 administrative staff (Harrison 2008).

There are 7 fire departments in Duchesne County (4 city departments and 3 rural departments) with a total of 95 volunteer firefighters. The county funds the city departments for coverage outside their boundaries and has 1 full-time employee to coordinate fire service and emergency management (Duchesne County 2006b).

Uintah County has multiple volunteer fire departments for areas outside of the BLM, U.S. Forest Service, and Uintah and Ouray Reservation boundaries. The local fire departments in Uintah County are Vernal/Uintah County (27 volunteers), Naples (18 volunteers), Jensen (17 volunteers), Lapoint-Tridell (15 volunteers), and Avalon (Uintah County 2006a).

3.8.6.4 Health Care

There are two hospitals in the study area.

- Ashley Valley Medical Center in Vernal is an accredited facility with 39 certified beds. The hospital is a short-term facility but all beds are available for long-term care (Hospital-Data.com 2007a).
- Uinta Basin Medical Center in Roosevelt (Duchesne County) is a non-accredited facility with 42 certified beds. The hospital is a short-term facility but all beds are available for long-term care (Hospital-Data.com 2007b).

The Uinta Basin Medical Center also operates clinics in Duchesne City, Altamont, and Tabiona, which are all in Duchesne County (Hyde 2006). Clinics of the TriCounty Health Department, which also serves Daggett County, provide screening and preventive services from locations in the Vernal, Roosevelt, and Duchesne (TriCounty Health Department 2008).

3.8.6.5 Schools

A countywide school district provides public education in each county. For the two districts combined, total enrollment of 10,082 students was projected in the fall of 2007. That total represents a 6.0 percent increase and 575 students over the past 5 years (**Table 3.8-20**). Enrollment gains have occurred in both districts, but most of the gains have occurred in the past 2 school years in the Uintah School District.

Table 3.8-20 Selected Characteristic, Duchesne County and Uintah School Districts

Number of Schools	Duchesne County School District	Uintah School District
Elementary and Middle	7	7
Junior and Senior High	5	3
Special and Alternative	3	1
Fall Enrollment		
2003	3,900	5,607
2004	3,894	5,642
2005	3,993	5,539
2006	3,982	5,787
2007 (projected)	4,042	6,040
Change 2003-07	4%	8%

Source: Utah State Office of Education 2007.

The Duchesne County School District completed a new building for Duchesne High School in the fall of 2005 and launched construction of a new junior high school in Roosevelt. Funding for the projects include a loan from the state's Revolving Loan Fund for education facilities, a no-interest loan from the Permanent Community Impact Fund jointly issued to the district and Duchesne County, and locally undertaken lease revenue bonds (Duchesne County School District 2006).

The Uintah School District completed a major addition and remodel to the Vernal Junior High in 2004-2005 using a combination of locally issued lease revenue, general obligation bonds, capital outlay reserves, and current funds for school programs needing the improvements (Uintah School District 2005).

High school students and adults have access to concurrent enrollment, advanced degrees, and career and technical training at the Roosevelt campus of the Utah College of Applied Technology (UCAT), and the Uinta Basin Campus of Utah State University with facilities in Vernal and Roosevelt (Utah State University 2007). There were 1,735 persons in workforce training programs at UCAT during the 2004-2995 school year (UCAT 2005).

3.8.6.6 Transportation

In Duchesne and Uintah counties, county government handles ongoing road maintenance and repair, and special service districts (SSDs) undertake capital construction projects primarily financed by allocations of federal mineral lease revenues and funds appropriated through UDOT for local, state, and federal aid transportation projects, and the Class B and C Road Funds (B and C refer to categories of local public roads) program.

3.8.7 Public Expenditures and Revenues

Total expenditures and shares by major government use of funds for Duchesne and Uintah counties are shown in **Table 3.8-21**. In Duchesne County, total expenditures were up by 12 percent in fiscal year (FY) 2006 compared to FY 2001, as Duchesne County's population grew by 7 percent. General inflation for the period was 13 percent. Total expenditures in Uintah County were up by 20 percent in FY 2006 compared to FY 2001, as the county's population rose 7 percent. County outlays increased mainly in the area of general government and public safety for both Duchesne County and Uintah County.

Table 3.8-21 Total County Expenditures by Use, in Millions

Expenditure	Duchesne County			Uintah County		
	2001	2006	Change	2001	2006	Change
General Government	$1.84	$2.65	44%	$3.22	$5.67	76%
Public Safety	$3.35	$4.80	43%	$2.98	$4.85	63%
Public Health	$0.21	$0.69	229%	$6.34	$4.31	-32%
Transportation and Public Improvements	$2.90	$1.27	-56%	$4.90	$5.34	9%
Culture, Recreation and Other Public Property	$0.30	$0.46	53%	$1.52	$2.91	91%
Housing and Economic Development	$0.46	$0.83	80%	$1.12	$0.81	-28%
Other Current Outlays[1]	$5.70	$5.87	3%	$1.66	$2.06	24%
Total	**$14.76**	**$16.57**	**12%**	**$21.72**	**$25.96**	**20%**

[1] Includes Capital Outlays, Debt Service, and Miscellaneous Expenditures. These outlays can vary dramatically from year to year.

Sources: Utah State Auditor 2006a, 2002a.

Total revenues and the main revenue sources for the counties are presented in **Table 3.8-22**. For counties, the reported revenue includes just the governmental-type funds within the primary government, plus SSDs, but excluding the reported revenue for enterprise funds. Total revenue grew from FY 2001 to FY 2006 by 33 percent in Duchesne County and by 65 percent in Uintah County. As shown, the most important sources of revenue raised locally by the general purpose governments are the property tax and the sales tax.

Table 3.8-22 Total Revenue for County Government, in Millions

Revenue Source	Duchesne County			Uintah County		
	2001	2006	Change	2001	2006	Change
Property Tax	$2.86	$6.18	116%	$4.55	$7.54	66%
Sales and Use Tax	$1.21	$1.62	34%	$5.01	$9.62	92%
Other Taxes, Licenses, Fees and Permits	$0.43	$0.22	-49%	$0.90	$2.12	136%
State Road Fund Allotment	$1.79	$1.99	11%	$2.89	$2.70	-7%

Table 3.8-22 Total Revenue for County Government, in Millions

Revenue Source	Duchesne County			Uintah County		
	2001	2006	Change	2001	2006	Change
Other Government Grants, Aid and Payments	$5.01	$1.28	-74%	$4.11	$6.51	58%
Charges, Interest and Miscellaneous	$1.71	$5.99	250%	$5.06	$8.65	71%
Total	**$13.02**	**$17.28**	**33%**	**$22.53**	**$37.15**	**65%**

Sources: Utah State Auditor 2006a, 2002a.

Expenditures by Roosevelt and Vernal, the main city governments of the area, also rose from FY 2001 to FY 2006 (**Table 3.8-23**). Total expenditures rose by 48 percent in Roosevelt and by 18 percent in Vernal, while population rose by about 9 percent and 6 percent, respectively. The largest increases in expenditures were for streets and parks and recreation in Roosevelt. Expenditures for health and general government led city spending growth in Vernal.

Table 3.8-23 Total City Expenditures by Use, in Millions

Expenditure	Roosevelt			Vernal		
	2001	2006	Change	2001	2006	Change
General Government	$0.47	$0.69	47%	$1.32	$1.78	35%
Public Safety	$0.84	$1.17	39%	$1.80	$2.11	17%
Public Health	$0.53	$0.75	42%	$0.96	$1.46	52%
Transportation and Public Improvements	$0.48	$1.12	133%	$1.92	$1.63	-15%
Culture, Recreation and Other Public Property	$0.61	$1.21	98%	$0.18	$0.15	-17%
Housing and Economic Development	$0.11	$0.10	-9%	$0.05	$0.07	40%
Other Current Outlays[1]	$1.06	$1.01	-5%	$1.81	$2.31	28%
Total	**$4.10**	**$6.05**	**48%**	**$8.04**	**$9.52**	**18%**

[1] Includes Capital Outlays, Debt Service, and Miscellaneous Expenditures. These outlays can vary dramatically from year to year.

Sources: Utah State Auditor 2006b, 2002b.

Total revenue grew from FY 2001 to FY 2006 by 19 percent in Roosevelt and by 20 percent in Vernal (**Table 3.8-24**). For cities, reported revenues include enterprise funds. City enterprise funds—which cover the water and sewer utilities in Roosevelt and Vernal—are integral to the cities' financial reporting. The revenue of school districts conforms to the mandated structure of school finance in Utah.

Table 3.8-24 Total Revenue for City Government, in Millions

Revenue Source	Roosevelt			Vernal		
	2001	2006	Change	2001	2006	Change
Property Tax	$0.38	$0.50	32%	$0.31	$0.33	6%
Sales and Use Tax	$1.21	$1.70	40%	$3.18	$5.54	74%
Other Taxes, Licenses, Fees and Permits	$0.38	$0.71	87%	$0.76	$1.23	62%

Table 3.8-24 Total Revenue for City Government, in Millions

Revenue Source	Roosevelt			Vernal		
	2001	2006	Change	2001	2006	Change
State Road Fund Allotment	$0.21	$0.65	210%	$0.29	$0.30	3%
Other Government Grants, Aid and Payments	$0.21	$0.44	110%	$0.64	$1.33	108%
Charges, Interest and Miscellaneous	$2.23	$1.49	-33%	$3.43	$1.58	-54%
Total	**$4.60**	**$5.49**	**19%**	**$8.60**	**$10.31**	**20%**

Sources: Utah State Auditor 2006b, 2002b.

Sales and use tax is especially important to cities because cities generally do not have taxable minerals development or production within their boundaries.

Expenditures also grew in the county school districts (**Table 3.8-25**). From school years 2001 to 2006, total expenditures grew by 55 percent in the Duchesne County School District and by 26 percent in the Uintah School District. Fall enrollments for the corresponding periods declined slightly (-0.3 percent) in Duchesne County and increased by just 1.1 percent in Uintah.

Table 3.8-25 Total Public School District Expenditures by Use, in Millions

Expenditure	Duchesne County School District			Uintah School District		
	2001	2006	Change	2001	2006	Change
Instruction	$13.44	$16.38	22%	$20.91	$22.89	9%
Support Services	$7.60	$9.65	27%	$10.37	$11.81	14%
School Lunch and Non-Instructional	$1.20	$1.31	9%	$2.00	$3.43	72%
Capital Facilities	$1.66	$9.31	461%	$2.07	$6.24	201%
Debt Service	$0.96	$1.80	88%	$0.30	$0.65	117%
Total Expenditures	**$24.85**	**$38.46**	**55%**	**$35.66**	**$45.02**	**26%**

Sources: Utah State Auditor 2006c, 2005, 2002c.

Property taxes are the only taxes levied by school districts. Though allotments from the State are by far the largest source of revenue for school districts, school districts do benefit from a larger tax base, as do local general purpose governments. The revenue of school districts conforms to the mandated structure of school finance in Utah. Total revenue grew from FY 2001 to FY 2006 by 19 percent in the Duchesne County School District and 21 percent in the Uintah School District (**Table 3.8-26**).

Table 3.8-26 Total Revenues for Public School Districts, in Millions

Revenue Source	Duchesne County School District			Uintah School District		
	2001	2006	Change	2001	2006	Change
Property Tax	$5.41	$7.22	33%	$7.45	$13.99	88%
Other Local Revenue	$0.51	$1.44	182%	$2.78	$2.92	5%
State Sources	$17.80	$18.18	2%	$22.75	$21.54	-5%
Federal Sources	$1.87	$3.60	93%	$4.26	$6.44	51%
Total Revenue	$25.59	$30.44	19%	$37.24	$44.88	21%

Sources: Utah State Auditor 2006c, 2005, 2002c.

Schools in Utah have some protection from changing demands and revenues that is not available to other local governments. The education foundation program, the Utah Minimum School Program, supports districts that do not raise at least a minimum amount per "weighted pupil unit," currently about $2,200. In addition, the State supports capital funding in districts with weak tax bases. State government directly benefits from lease royalties and taxes that are specific to minerals production, while local governments benefit indirectly. In Utah, mineral lease revenues, which are 50 percent of the royalties and bonuses collected on federal resources in the State, are distributed to State agencies and to local entities by appropriation or statutory formula.

In 2006, the ad valorem tax base for the counties and school districts exceeded $1.1 billion in Duchesne County and $2.8 billion in Uintah County (**Table 3.8-27**). Natural resources and related facilities are important components of the ad valorem/property tax base of the main government entities in Duchesne and Uintah counties. In 2006, total centrally assessed property, which includes natural resources as well as pipelines, railroads, electric utilities, and telecommunications facilities that also may be related to natural resources development, comprises 47 percent of total taxable value in Duchesne County and 60 percent in Uintah County. Oil and gas production are 39 percent of total taxable value in Duchesne County and 46 percent in Uintah County.

Table 3.8-27 Ad Valorem Tax Base of Local Governments, 2006 (In Millions)

Government	Total Taxable Value[1]	Locally Assessed	Centrally Assessed	Oil and Gas Value (Included in Centrally Assessed)
Duchesne County and School District	$1,113.8	$588.2	$525.6	$439.7
Roosevelt	$143.8	$131.8	$12.0	NA
Uintah County and School District	$2,809.1	$1,137.4	$1,671.7	$1,299.8
Vernal	$398.9	$384.8	$14.1	NA

[1] Sum of land, buildings, personal property and centrally assessed property. The taxable valuation for a county government and the corresponding county school district are the same because the jurisdictional boundary and tax base are the same for each entity.

Source: Utah State Tax Commission 2007a,b.

As already noted, both counties and cities also rely on sales tax revenues, which respond both directly and indirectly to natural resources development. Taxes are collected on consumer purchases made by individuals and households employed by natural resources developers and supporting industries. Sales taxes are paid directly by oil and gas operations when purchases of equipment, materials, or supplies are made in the local area. Examples of industry purchases that generate sales tax revenue are gravel, pipe, fuel, and other supplies purchased locally.

In addition to property taxes and sales taxes derived from natural resource operations, Duchesne and Uintah counties receive payments-in-lieu of taxes (PILT) from the federal government for all public lands within the county. The federal PILT to counties are to offset foregone property tax revenues due to the tax exempt status of the public lands and to partially compensate local governments for the costs of services (e.g., law enforcement or emergency medical services provided to the public on public lands). PILT payments are a function of the amount of eligible federal acres in a county, subject to certain population-related caps and the level of Congressional appropriations. PILT payments are relatively stable from year to year. In federal fiscal year 2006, PILT payments of $803,141 and $1,309,658 were made to Duchesne and Uintah counties, respectively.

The federal minerals royalty revenue sharing program, through which approximately one-half of the federal mineral royalties from local production is returned to the state (a portion of which is in turn redistributed locally), is a source of current revenue and capital funding for local government. In Utah, the revenue sharing and capital funds provisions generally correlate with growth in areas that host oil and gas development on public lands. Utah's federal mineral lease revenue was $156.9 million in FY 2006, up from $82.7 million. Thirty-seven percent is appropriated to the UDOT for redistribution to counties and, subsequently, to local SSDs. The state

also allocated 32.5 percent of the mineral royalties to the Permanent Community Impact Fund, which is used to provide loans and/or grants to state agencies and subdivisions of the state that are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands.

As shown in **Table 3.8-28**, distributions of mineral lease revenues directly to Duchesne and Uintah counties through UDOT increased several fold since 2001. Historically, these funds are used for transportation and recreation projects but more recently, for other facilities and services authorized by statute. Duchesne County uses its funding for road work (Duchesne County SSD #2 2004). Uintah County uses mineral lease grants and loans for SSDs whose missions are roads, recreation, health, mental health and substance abuse, animal control, economic development, and wildfire suppression (Uintah County 2006b).

Table 3.8-28 Mineral Lease Distributions to Duchesne and Uintah Counties from UDOT Appropriation, in Millions

Fiscal Year[1]	Duchesne County[2]	Uintah County[2]
2001	$0.79	$6.86
2002	$0.72	$3.03
2003	$0.68	$6.89
2004	$0.93	$11.77
2005	$1.90	$16.70
2006	$2.75	$27.50
2007	$3.15	$27.18

[1] Data are for fiscal years ending June 30.

[2] Distributions by county are allocated in proportion to the amount of mineral lease money generated by each county. Within counties distributions are determined by the county legislative body. Revenues are derived from lease bonuses and production royalties of activities located in each county.

Source: UDOT 2008.

Note that although Duchesne County is a high oil producing county, its federal mineral lease revenue allocation from the UDOT appropriation is relatively low. This is because production from federally owned minerals is a small though growing fraction of total production from the county's oil fields. Most of the oil produced in Duchesne County is from private or Ute Tribal mineral rights.

Over time the cumulative amount of grants and loans to Duchesne and Uintah counties from the Permanent Community Impact Fund total $12.8 million and $25.2 million, respectively (**Table 3.8-29**). Under the Permanent Community Impact Fund's charter, these funds are targeted to the planning, construction, and maintenance of public facilities and services in areas that may be socially or economically impacted by minerals development on federal lands.

Table 3.8-29 Utah Permanent Community Impact Fund Grant and Loan Funding, Fiscal Years 2001 to 2005

Allocation (Millions)[1]	Duchesne County	Uintah County
Permanent Community Impact Fund Allocation	$12.8	$25.2
Allocated As Grants	$5.1	$8.9
Percent Grants	40%	35%
Allocated As Loans	$7.7	$16.3
Percent Loans	60%	65%

[1] Grants and loans go to local governments and other State sub-divisions located in each county.

Source: Natural Resources Impact Working Group 2005.

Federal minerals production also yields severance tax revenues. Revenue from the Utah Severance Tax goes to the State's general fund. The tax is assessed on the value of production, minus allowed deductions, at the rate of 3 percent on the first $1.50 per mcf (thousand cubic feet) of gas and 5 percent on the amount over that. The Ute Tribe receives royalties on oil and gas production from Tribal mineral interests.

3.8.8 Population and Employment Projections

The state prepares long-term population and employment projections for all counties in Utah under baseline conditions (i.e., continuation of general statewide and regional economic trends). Although natural resource development factors into the projections for Duchesne and Uintah counties, the projections do not reflect discrete development assumptions related to any site-specific development plan. As shown in **Table 3.8-30**, current long-term demographic projections for the period 2007 to 2040 anticipate population growth of nearly 6,400 residents in Duchesne County and more than 13,700 residents in Uintah County. Statewide growth is projected to remain strong, topping 4.0 million by 2025 and 5.0 million by 2039. Population projections for the cities are not published by the State of Utah's long-term projections program.

Table 3.8-30 Population Projections to 2040

Projection Year	Duchesne County	Uintah County	Uinta Basin MCD[1]	State of Utah (Millions)
2007 Estimate	16,163	28,806	45,938	2.700
2010	17,336	31,379	49,707	2.928
2020	20,130	37,950	59,156	3.653
2030	21,533	40,638	63,326	4.388
2040	22,561	42,536	66,328	5.171
2007-40 CAGR	1.0%	1.2%	1.1%	2.0%

[1] MCD = Multi-county district. Uinta Basin MCD = Daggett, Duchesne, and Uintah counties.

Source: UGOPB 2008.

The projected population growth rates in Duchesne and Uintah counties are comparable, as are the projected employment growth rates (**Tables 3.8-30** and **3.8-31**).

Table 3.8-31 Employment Projections to 2040

Projection Year	Duchesne County	Uintah County	Uinta Basin MCD	State of Utah (Millions)
2007	10,413	19,563	30,688	1.66
2010	11,015	20,799	32,548	1.80
2020	11,689	21,932	34,392	2.20
2030	12,228	22,822	35,851	2.56
2040	12,899	23,876	37,616	2.97
2007-40 CAGR	0.7%	0.6%	0.6%	1.8%

Source: UGOPB 2008.

3.8.9 Community Social Conditions

The first sub-section discusses the relationship of the nearby counties and communities to the GNBPA. The second sub-section discusses the affected groups.

3.8.9.1 Counties and Communities

Duchesne and Uintah counties contain many small towns that are separated from the major cities of Utah or nearby Grand Junction, Colorado, by 2 hours or more of highway travel. In each community near the GNBPA, schools, churches, local government, and local institutions are touchstones of a social structure based on relationships among neighbors, acquaintances, and members of community groups and institutions. The communities of the region remain, as they have been historically, central places within large rural areas. Private lands are adjoined by large tracts of public land that hold valuable and strategic natural resources. The public lands, which occupy 60 to 70 percent of the surface area in each county, are pivotal to the region's sense of place and plans for the future.

Community identity for most of the population in Uintah and Duchesne counties is tied to use of the land and natural resources, and to an economic dependency on public lands. The public in both counties is keenly aware of this and sensitive to the fact that public lands management impacts their economic well being (BLM 2008b).

According to the Uintah County General Plan (Uintah County 2005), residents value the county's rural character, quiet lifestyle, natural landscapes, and open spaces. The plan states that maintaining these values is one of the top priorities of county residents. The plan states the belief that Uintah County depends on the use and development of natural resources for its economic well-being and defines county government's role as strongly supporting "the rights of Uintah County residents and businesses to responsibly use and develop natural resources" (Uintah County 2005). With respect to public lands management, the general plan states that county policy is to support "multiple-use," responsible resource use and development, and improved public and private access to and across public lands.

In Duchesne County, the County General Plan (Duchesne County 2005) identifies oil and gas and agriculture as significant to the county's economic well being. The public's planning priorities, according to the document, are maintaining a rural character and lifestyle; local participation in public land management issues; natural resource development; economic development; private land use issues; and human services, particularly education.

According to the Duchesne County General Plan, oil and gas has become more important to the local economy since the 1980s, so it is "in the economic interest of the county citizens and government" to promote access to public land to develop this resource (Duchesne County 2005). The general plan also states that recreation and tourism are part of the county's economy and should be encouraged for their stabilizing effect. The plan adds that public lands development should consider impacts to recreational activities and be sensitive to values like rural lifestyle, quality of life, and scenic environment. However, county officials also may assert that the economic benefits of resource development outweigh those of tourism (Hyde 2006).

Members of the Ute Tribe reside within and near the GNBPA. Over half of the Tribal membership chooses to live on the Uintah and Ouray Reservation (Ute Indian Tribe 2008), which occupies a large percentage of the land area in Uintah and Duchesne counties. Sovereignty over the land and resources of the reservation reinforces the Tribe's separate social and cultural identity. The Ute Tribe receives royalties on oil and gas production from Tribal mineral rights.

A survey conducted in 2004 (Duchesne County 2005) indicated that Tribal members see social benefits from residency on the reservation. The three aspects of life on the reservation that surveyed Tribal members liked the most were: 1) closeness to family, a sense of community, neighbors, cultural/community/ Episcopal activities; 2) natural resources, scenery, mountains, clean air and clean water, wildlife, lots of space; and 3) no taxes, tax exempt, lower cost of living. The issues for the Tribe that members ranked as most important were: 1) Tribal management, committee relations, and housing maintenance; 2) health services; and 3) resource development.

"Tribal/non-Tribal relations" were identified as an issue of moderate importance to members of the Ute Tribe in the 1994 survey (Duchesne County 2005). Counties also acknowledge the importance of cooperation and mutual sensitivity in relations with the Tribe. The Uintah County General Plan states that "cooperation between the Tribe and the County is necessary to ... address many Uinta Basin social and economic concerns and issues" (Uintah County 2005). The Duchesne County General Plan states that "resource use or development on private, public, or Tribal Lands should be sensitive to Tribal interests and the County's rural lifestyle, quality of life, and scenic environment" (Duchesne County 2005).

3.8.9.2 Affected Groups

Discussions of affected groups are included to structure the assessment of social impacts. Information from the BLM Vernal RMP (BLM 2008b) suggests that the attitudes and values regarding motorized access to public lands, conservation of wildlife, protection of areas with special designation, and economic development likely are to be salient in the public perceptions of and reactions to a proposed action that involves natural gas development on public lands. Groups that share some or all of these values may be assumed to have similar attitudes and opinions toward development. For additional information regarding how Utahans use and value public land resources and their views toward the management of those lands, refer to *The Structure and Economic Impact of Utah's Oil and Gas Exploration and Production Industry, Phase I – The Uintah Basin* (University of Utah 2007), and a companion report focusing on responses from the Uinta Basin, *Public Lands and Utah Communities: A Statewide Survey of Utah Resident* (Utah State University 2009). Key findings from the latter also are summarized in Appendix M of the Vernal RMP (BLM 2008b).

It should be noted that these following discussions may generalize the actual values of individual group members. In addition, the presentation format is not meant to imply that these groups are mutually exclusive or that members of each group do not share interests with other groups. Furthermore, people's attitudes and interests may change over time for a variety of reasons.

Individuals and Groups Who Give High Priority to Motorized Access to Public Lands

This group includes motorized recreationists (such as trail motorcycle, four-wheel-drive, and OHV enthusiasts); people with a business or professional need for motorized access; and businesses that supply vehicles and related goods and services. The group prefers to retain all motorized access and supports measures to promote safety, not access closure, wherever multiple-use might lead to traffic hazards. More recreation-oriented members of the group also want to protect visual quality and wildlife as part of their motorized trail use experience.

Individuals and Groups Who Give High Priority to Conservation of Wildlife

Members of this group and their supporters focus on the potential for impacts to wildlife and wildlife habitat, as well as other natural resource values associated with natural wildlife habitat. The comments emphasize the concern that these values should be studied for potential conflict with gas development and that mitigation be considered for the potential damage caused to the environment.

Individuals and Groups Who Give High Priority to Protection of Areas with Special Designation

These individuals and groups indicate that the status of lands in or near the GNBPA that have special BLM land use designation areas is important because they value their naturalness, their uniqueness or increasing rarity, their benefits for recreation, their place in the environment, or their value as a source of knowledge.

Groups with an interest in special designation areas indicated that their members may support these ideas because they want to protect personal, professional, lifestyle, or political values. In addition, many comments focused on an interest in preserving these areas for the benefit of future generations.

Individuals and Groups Who Give High Priority to Economic Use of Resources

Comments commonly offered during public scoping on energy development proposals in the region express concern that resources on public land be made available for use to contribute to economic development and strategic benefits at the local, regional, and national level. Individuals and groups stating this concern did so because they live, work, or represent interests in communities that have benefited socio-economically from development of natural resources on public lands. Some groups offered these concerns because they represent industry, or they represent businesses that sell to industry.

These groups indicate that gas development provides high paying jobs, stimulates the local economy, supports public facilities and services, and historically has been part of the local social and economic structure. Many comments show support for what they see as the need to encourage development to promote local social and economic stability.

Some comments stated the belief that development can occur without destroying other resources and values, especially if there is mitigation. Concerns of this kind came from local government concerned over impacts to roads and public safety service providers.

3.8.10 Environmental Justice

Environmental justice is the principle defined by EO 12898 and implemented by agency directives (BLM 2002b) that low-income, minority, and Tribal groups should not have to experience a disproportionate share of any negative effects resulting from a plan or project. The principle is violated when a government action results in a disproportionate adverse effect on low-income, minority or Tribal populations.

Table 3.8-32 shows the proportions of low-income, minority, and Tribal populations in selected communities in Duchesne and Uintah counties. The table includes the main communities in each county near the GNBPA plus three communities on the Uintah and Ouray Reservation. Data for the State of Utah are shown for comparison. The reservation communities are Fort Duchesne, Randlett, and Whiterocks. These communities are Census Designated Places (CDP) and they are the only boundary-defined places within the jurisdiction of the Uintah and Ouray Reservation that were enumerated by the U.S. Census Bureau in 2000. Fort Duchesne is the headquarters location of the Ute Tribe.

Table 3.8-32 Poverty and Minority Population Characteristics of Selected Communities, 2000

Population[1]	Percent of Total Population in Poverty	Minority Race or Hispanic as Percent of Total Population[2]	Percent American Indian
Duchesne County	16.8	8.8	5.4
Duchesne City	12.4	3.8	0.7
Roosevelt	22.1	11.7	8.1
Uintah County	14.5	12.6	9.4
Vernal	14.8	6.8	2.3
Uintah and Ouray Reservation	20.2	17.5	14.5
Fort Duchesne CDP	54.6	90.9	90.2
Randlett CDP	54.5	95.0	93.3
Whiterocks CDP	70.9	93.8	93.8
State of Utah	9.4	12.6	1.3

[1] Unincorporated communities with boundaries defined for purposes of enumeration during the decennial census.
[2] The minority race or Hispanic population is the total minority population comprising all persons of a minority racial identity plus persons of Hispanic-origin identity not already included because of race.

Source: U.S. Census Bureau 2000a,c.

The BLM standard for identifying a low-income population is the poverty level used by the U.S. Census Bureau. The standard for identifying minority populations is either: 1) the minority population of the affected area exceeds 50 percent, or 2) the minority population percentage of the affected area is "meaningfully greater" than the minority population percentage in the general population or other appropriate unit of geographic analysis. For environmental justice compliance, the relevant minority population is the total minority population comprising all persons of a minority racial identity plus persons of Hispanic-origin identity (BLM 2002b).

Resident populations with a poverty rate over 50 percent exist in Fort Duchesne, Randlett, and Whiterocks. Elsewhere in Duchesne and Uintah counties, the poverty rate varies from 12.4 percent to 22.1 percent, compared to 9.4 percent in the state overall. Fort Duchesne, Randlett and Whiterocks are minority communities. The population of these places is more than 90 percent minority and more than 90 percent American Indian or other closely related racial identity. This is consistent with information provided by a 1994 survey of members of the Ute Tribe that indicated that 64 percent of members living in Utah reside in Whiterocks, 16 percent in Fort Duchesne, and 8 percent in Randlett, with the remainder in Lapoint, Ouray, and Indian Bench, the latter being communities not enumerated by the U.S. Census Bureau (Duchesne County 2005). Elsewhere in Duchesne and Uintah counties, the minority population percentage is not meaningfully higher than the state average (**Table 3.8-32**).

3.9 Soils

3.9.1 Soils Characterization

The study area for soils is the GNBPA. The soil baseline characterization for the project is based on Soil Survey Geographic (SSURGO) database review and analyses. Field mapping methods using national standards are used to construct the soil maps in the SSURGO database. Mapping scales generally range from 1:12,000 to 1:63,360. SSURGO is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS).

SSURGO data cannot be used in areas where soil surveys have not yet been completed. General Soil Map (STATSGO) data are used for those areas where SSURGO data are unavailable. STATSGO data contain physical and chemical properties, as well as interpretative grouping for approximately 18,000 soil series recognized in the U.S.

Soils within the GNBPA developed on a variety of land surfaces remaining after the differential erosion of plateau surfaces of the gently dipping strata of the underlying Uinta Formation. Upland soils in the GNBPA are developed on smooth to undulating plateau surfaces, erosion remnants, structural benches, and smaller benches interspersed with areas of high relief comprised of escarpments, hills, tableland breaks, badlands, and slopes of dissected, incised stream valleys. In the valley bottoms, soils formed in alluvium on alluvial fans, terraces, floodplains, and alluvial flats. The residual, colluvial, and alluvial parent materials consist of interbedded shales and sandstones of the Uinta Formation, and to a lesser extent, the formation's limestones and quartzite deposits. Areas of eolian sand deposits occupy portions of plateau surfaces and moderately sloping hillsides throughout the GNBPA. Upland soils comprise approximately 75 percent of the GNBPA's soil resource and typically are sandy or loamy and shallow. Less extensive moderately deep and deep upland soils comprise approximately 14 percent of the GNBPA. The finer textured bottomland soils of the valley fans, floodplains, flats, and terraces comprise approximately 11 percent of the GNBPA. Throughout the GNBPA, soils have elevated levels of salts (16 millimhos per centimeter [mmhos/cm]) and absorbed sodium (sodium absorption ratio 30-60). Coarse fragments are present in most soils within intermittent and ephemeral drainages in the GNBPA. Alluvial soils along the White River are mostly free of coarse fragments.

A total of 25 soil map units occur within the GNBPA. These soils have been mapped at a detailed level of soil survey (**Appendix F**). Mapping at the detailed level covers approximately 122,901 acres (75 percent) of the GNBPA. The remaining 40,010 acres (25 percent) of the GNBPA are covered by general STATSGO soils mapping. Based on reviews of topographic, geomorphological, geological conditions, and an evaluation of both soil surveys, the soil mapping units identified and described in the detailed survey are expected to extend into and occur on comparable landscapes of those lands covered by only the general STATSGO soil survey within the GNBPA.

3.9.2 Soil Constraints

Soils were grouped based on constraints posed by disturbance associated with construction, operation, and reclamation of the natural gas wells and related facilities. The primary goal for interim and final reclamation would be to establish soil stability and restore soil productivity. Constraints considered soil disturbances such as blading, excavation, and compaction of soils beneath equipment or facilities. Exposed, loosened soil materials left on steeper slopes (cut and fill slopes) would be subject to accelerated soil erosion due to precipitation events and runoff. The potential for accelerated erosion increases with slope angle and slope length and can be exacerbated by removal of protective vegetative or rock cover and loss of soil aggregation. Accelerated erosion can lead to soil loss, slope instability (cut and fillslopes), and subsequent mass wasting that can affect project operations. Accelerated erosion, as evidenced by head-cutting diversion channels back from natural drainages to roads, primarily access roads to oil and gas facilities, is an ongoing problem in the GNBPA. Constraints on soil reclamation potential in the GNBPA primarily are: 1) shallow depth to bedrock that is indicative of droughty and poor nutrient status soil conditions; 2) elevated salinity levels that can affect plant establishment and water uptake; 3) elevated sodicity that can affect soil water and oxygen availability; and

4) the high coarse fragment content of soils in the GNBPA. Compaction of soils during construction or operational activities can reduce soil water and oxygen availability, and compaction of sodic soils can exacerbate the elevated sodium problem. One major component of the 25 soil map units identified in the GNBPA by the SSURGO database had a topsoil material quality rating of fair while the remaining 24 soil map units' major components rated poor or were not rated due to the relative absence of soil materials in areas mapped as badlands and/or rock outcrops (**Appendix F**).

Based on the type and prevalence of constraining soil characteristics in the GNBPA (USDA 1994) and the arid conditions that have been exacerbated by years of drought, the 25 soil map units have been grouped into:

- High constraint soils that pose the greatest construction and reclamation constraints;
- Those with moderate constraints; and
- Those with low constraints.

Appendix F identifies the factors used to develop the constraint groupings. **Figure 3.9-1** depicts the distribution of these groupings within non-tribal portions of the GNBPA. Constraints were extrapolated to Tribal Lands based on topography, parent materials, and general soil survey data.

3.9.2.1 High Constraint Soils

As a group, high-constraint soils:

- Overlay steep slopes (slopes greater than 20 percent);
- Are shallow to bedrock;
- Contain high percentages of coarse fragments;
- Have a high water erosion potential;
- Contain elevated salinity and/or sodium levels; and
- Include areas of limited soil materials where badlands have developed and where rock outcrops are exposed.

This group of high constraint soils occupies approximately 93.5 percent (152,300 acres) of the GNBPA (**Appendix F**).

3.9.2.2 Moderate Constraint Soils

As a group, moderate constraint soils:

- Overlay less steep slopes of 8 to 20 percent;
- Are generally moderately deep or deep to bedrock;
- Contain moderate to high percentages of coarse fragments;
- Have a moderate water erosion potential principally due to reduced slopes (less than 25 percent) and coarse fragment content;
- Contain moderate levels of salinity and/or sodium; and
- Include areas of sandy (droughty) textured materials with high to very high wind erosion potential.

This group of moderate constraint soils occupies approximately 3 percent (4,900 acres) of the GNBPA (**Appendix F**).

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T8S R21E
T8S R22E
T8S R23E
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T9S R20E
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T10S R20E
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T10S R22E
T10S R23E
T10S R24E
T11S R20E
T11S R21E
T11S R22E
T11S R23E
T11S R24E
Green River
Green River
White River
Bitter Creek
White River
Hill Creek
Willow Creek
Willow Creek

Utah
Area of Detail
Uintah County

Legend

- EIS ProjectArea
- Township/Range
- Named Streams and Rivers
- No SSURGO Soil Data Available

Soil Constraints

- High
- Medium
- Low
- Minor Soils

N

1 0.5 0 1 2
Scale in Miles
2 1.5 1 0.5 0 2
Scale in Kilometers

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Figure 3.9-1

Soil Contraints

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3.9.2.3 Low Constraint Soils

As a group, low constraint soils:

- Occupy level to gently sloping drainages and alluvial bottoms of less than 8 percent;
- Are generally deep soils;
- Contain low to moderate levels of coarse fragments;
- Have low to moderate water erosion potential, due to minimal slopes; and
- Contain slight to moderate levels of salinity and/or sodium.

This group of low constraint soils occupies approximately 3.5 percent (5,700 acres) of the GNBPA (**Appendix F**).

3.9.3 Biological Soil Crusts

Biological soil crusts (BSCs) occur within the GNBPA on the surface of mostly undisturbed soils supporting the dominant salt-desert shrubland, sagebrush shrubland, grassland, and to a lesser extent pinyon-juniper woodland vegetation types. BSCs are composed of various organisms including bacteria, green algae, lichens, mosses, and micro-fungi that symbiotically form a rough carpet on the surface and a soil-binding matrix below (Belnap et al. 2001). On the Colorado Plateau, in which the GNBPA is located, the predominant cyanobacterial-lichen soil crusts often provide up to 10 percent of the living cover (Belnap and Gardner 1993). BSCs as a group are quite adaptable to a full range of soil types from shallow to deep, heavy to light textures, and moist to drier conditions on slopes ranging from level to steep. Given this adaptability, soil crusts are expected to occur across much of the GNBPA. Steeper slopes supporting mostly unstable soils and those areas lacking soil cover such as badlands and rock outcrops, generally do not support BSCs. The BSCs typically occupy interspaces of open ground between higher vascular plants or below their canopies (Belnap and Gardner 1993).

In semi-arid and arid environments, BSC cover fixes carbon and nitrogen for other plants, reduces surface reflection and raises soil temperature, increases water infiltration rates, and stabilizes soils by reducing water and wind erosion (Belnap et al. 2001). Nitrogen fixation improves soil fertility by increasing availability of nitrogen fertility in typically nutrient poor systems such as the semi-arid landscapes within the GNBPA (Muscha and Hild 2006; Belnap and Gardner 1993). Because soils with developed BSCs generally are dark in color, they absorb more of the sun's energy as heat, which can positively increase microbial activity, increase plant nutrient uptake, promote higher plant seed germination of native vascular plants adapted to BSCs, and increase seedling growth rates. The roughened surface produced by the raised expression of BSCs can act as detention structures for water and affect increased water infiltration to the benefit of both BSCs and higher plants in the cool deserts of the Colorado Plateau (Belnap et al. 2001). Cyanobacterial-lichen BSCs of the Colorado Plateau and the GNBPA entrap and bind soil particles together, increasing the size of soil aggregates, which in turn increases their resistance to the erosive forces of wind and water (Belnap et al. 2001; Belnap and Gardner 1993).

BSCs generally enhance the establishment of vascular plants by improving the soil medium for plant growth (Muscha and Hild 2006). In general, healthy, stable landscapes dominated by native vegetation contain higher diversity and cover of biotic crusts.

Threats to BSCs generally arise from damage or loss of BSCs due to disturbance including fire, drought, invasive and non-native plant infestations, livestock trampling, human foot traffic, motorized vehicle passage, and blading or excavation of the soil surface and BSCs as part of construction activities (Belnap et al. 2001). The rate of natural recovery of BSCs in disturbed areas is dependent on the type and severity of disturbance and the availability of BSCs to recolonize the affected areas.

3.10 Transportation and Access

The study area for transportation and access is the GNBPA plus the regional highway network. The GNBPA is located approximately 25 miles due south of the intersection of U.S. Highway 40 and U.S. Highway 191 (**Figure 3.10-1**). Access to the western part of the GNBPA is by Utah State Route 88, which heads east near the GNBPA boundary and continues through the northern portion before it connects to Utah State Route 45. Access to the eastern part of the GNBPA is by Utah State Route 45, which runs just to the east of the study area. Several rural roads branch off from these two state highways into the GNBPA, with the most substantial rural road being the Glen Bench Road. Additionally, there are several existing rural roads and 4-wheel drive trails throughout the GNBPA.

Most of the unpaved roads within the GNBPA are claimed as Class B and D roads by Uintah County and are, therefore, public roads. The remaining roads are short, dead-end roads used to access well pads. These roads would not be considered "through" roads by the public, rendering their use by the public unlikely.

There were approximately 766 miles of roads within the GNBPA as of October 2007. The majority of the roads in the area is rural in nature or associated with oil and gas development. Of the 766 miles of roads with the GNBPA, 49 miles are maintained by the BLM. **Table 3.10-1** provides a breakdown of the BLM maintained roads. Traffic counts for roads in the vicinity of the GNBPA are provided in **Table 3.10-2**. Level of Service data for maintained gravel roads within the GNBPA is not available. The nearest railroad access is approximately 1 mile north of the northeastern portion of the GNBPA.

Table 3.10-1 BLM Road Types within the GNBPA

BLM Road Type	Miles
Local, neighborhood, and rural roads	39
Vehicular trail, passable only by 4-wheel drive	10

Table 3.10-2 Traffic Density for Project Region

Location	Annual Average Daily Traffic (ADT) (2006, 2007)	Percent Truck Traffic	Road Capacity (ADT)
State Road (SR) 88, south of Ouray	1,280	30	0-6,000
SR 45, at Bonanza	410	45	0-6,000
Watson Road at Ouray	1,168	17	N/A
Glen Bench Road, south of State Route 45			
• Fidar and Glen Bench Road intersection	1,157	39	N/A
• Mountain Fuel Bridge	630	26	N/A
• Chapita Grove/Glen Bench	878	45	N/A

Source: Bedell 2008.

Crude oil transport in the Uintah County region is often conducted by supertankers, or longer combination vehicles. These vehicles weigh up to 129,000 pounds; carry up to 84,000 pounds of crude; and can be 105 feet in length. Within the Uinta Basin, these types of trucks constitute a small part, 5 percent, of the overall oil and gas related truck traffic (Kuhn 2006).

Under the Vernal RMP, there are areas where off-road vehicle travel is limited and areas that are closed to off-road vehicle travel. "Limited" OHV areas limit off-road vehicles to designated trails and routes, mainly for watershed protection and wildlife values. As noted in **Figure 3.10-1**, there is a small portion of the area along the White River that is closed to off-road vehicles due to recreation values. This area is a part of a larger ROW exclusion area identified in the Vernal RMP. Several utility corridors that are identified in the Vernal RMP pass through the GNBPA.

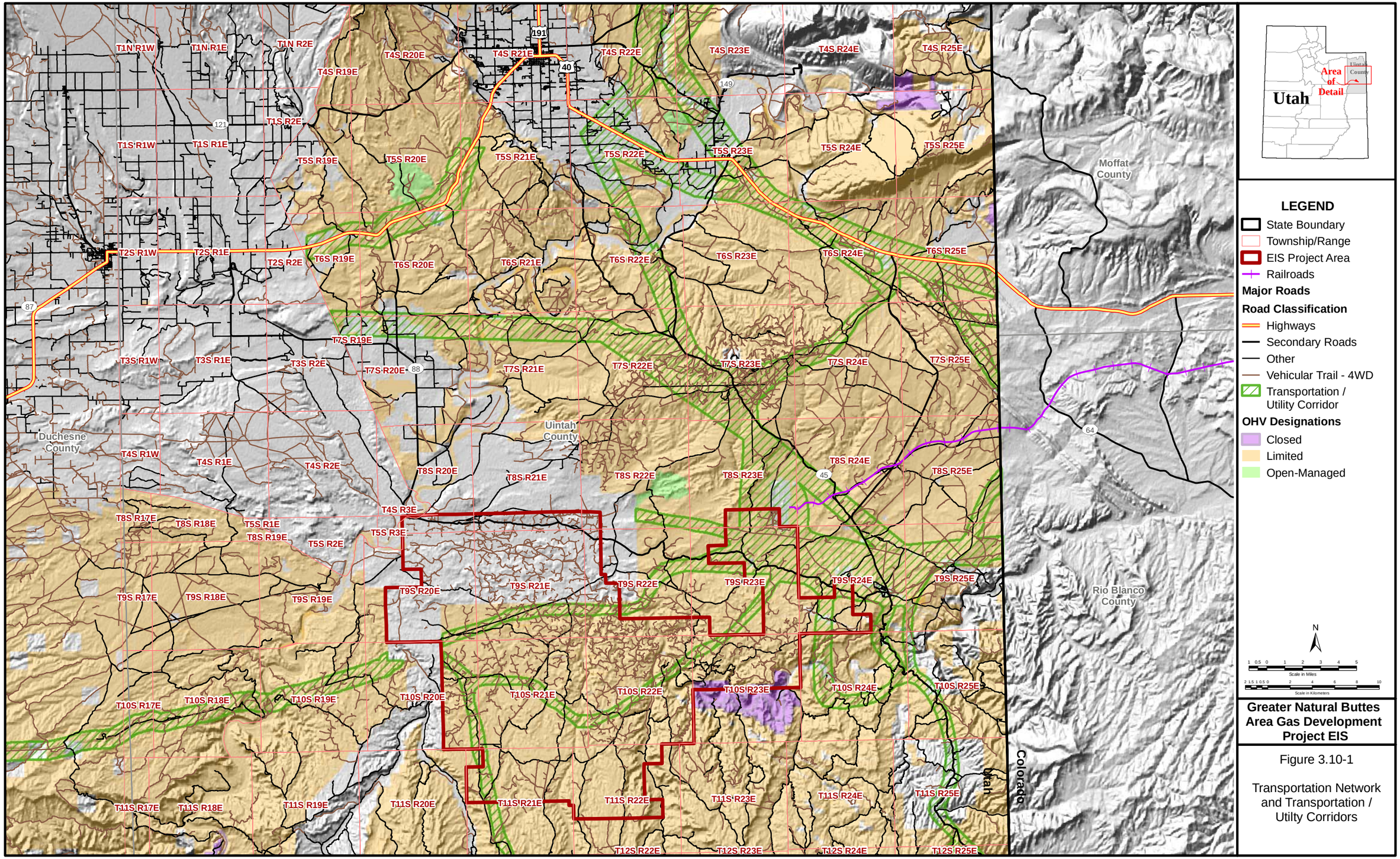

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Figure 3.10-1

Transportation Network and Transportation / Utilty Corridors

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3.11 Vegetation Resources

The study area for vegetation resources including general vegetation, noxious weeds and invasive species, and special status plant species is defined as the GNBPA. The following section presents general vegetation resources and noxious weeds and invasive species for the study area.

3.11.1 General Vegetation

The GNBPA is located entirely within the Uinta Basin floristic region as defined by the Eastern Tavaputs Plateau. Vegetation types and acreages were analyzed using Southwest Regional GAP Analysis Project (SWReGAP) geographic information system (GIS) data. Community characterizations were compiled based on aerial photograph interpretation, SWReGAP Land Cover descriptions (USGS 2005), and information from the BLM Vernal RMP (BLM 2008b). Nine vegetation cover types occur within the GNBPA. The vegetation cover types include salt-desert shrubland, sagebrush shrubland, pinyon-juniper woodland, cliff/canyon, grassland, agriculture, riparian habitats, developed (i.e., industrial/commercial), and barren lands. Distribution of vegetation types in these areas are strongly influenced by variations in landscape position, soil type, moisture, elevation, and aspect. Descriptions of the plant communities in each of these vegetation cover types are provided in the following text. Species nomenclature is consistent with the BLM Vernal RMP (BLM 2008b) and NRCS Plants Database (NRCS 2008a). **Figure 3.11-1** illustrates the vegetation cover types present within the GNBPA. **Table 3.11-1** summarizes acreages for each vegetation cover type within the GNBPA.

Table 3.11-1 Vegetation Cover Types within the GNBPA

Vegetation Cover Types	Acres	Percent of GNBPA[1]
Salt-desert shrubland	66,875	41
Sagebrush shrubland	57,612	35
Grassland	15,778	10
Cliff/canyon	7,513	5
Riparian	4,961	3
Pinyon-juniper woodland	2,851	2
Agriculture	1,030	<1
Barren	6,208	4
Developed	83	<1
Total	**162,911**	**100**

[1] Percentages total to more than 100 percent due to rounding.

3.11.1.1 Salt-desert Shrubland

Salt-desert shrubland is the most dominant vegetation cover type within the study area, occurring on lower elevational slopes, saline basins, alluvial slopes, and plains. Substrates are often saline and calcareous, medium to fine-textured, alkaline soils, but include some course-textured material. This cover type is characterized by an open to moderately dense shrubland dominated by shadscale (*Atriplex confertilfolia*), four-winged saltbush (*Atriplex canescens*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Chrysothamnus nauseosa*), Mormon tea (*Ephedra nevadensis*), spiny hopsage (*Grayia spinosa*), winterfat (*Ceratoides lanata*), and littleleaf horsebrush (*Tetradymia glabrata*). The understory is comprised of galleta (*Hilaria jamesii*), Indian ricegrass (*Stipa hymenoides*), blue grama (*Bouteloua gracilis*), thickspike wheatgrass (*Agropyron dasystachyum* var. *dasystachysum*), western wheatgrass (*Agrpyron smithii*), and a small variety of forbs including primrose (*Camissonia* sp., *Oenothera* sp.), Steve's dustymaiden (*Chaenactis stevoides*), and annual buckwheat (*Eriogonum* sp.) (NRCS 2008a; USGS 2005).

3.11.1.2 Sagebrush Shrubland

Sagebrush shrubland occupies lower elevational areas of the Uinta Basin and Inter-Mountain Basin ecoregions. Soils are typically deep, well-drained, and non-saline. These shrublands are dominated by Wyoming big sagebrush, rubber rabbitbrush, greasewood (*Sarcobatus vermiculatus*), juniper species (*Juniperus* spp.), and saltbush species (*Atriplex* spp.). The herbaceous component contributes less than 25 percent of the vegetation in this type and is comprised of Indian ricegrass, blue grama, thickspike wheatgrass, Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa sandbergii*), needle-and-thread grass (*Stipa comata*), and Great Basin wildrye (*Elymus cinereus* var*. cinereus*) (NRCS 2008a; USGS 2005).

3.11.1.3 Grassland

Grassland communities typically occupy xeric lowland and upland areas including swales, playas, mesatops, plateau parks, alluvial flats, and plains. Substrates are often well-drained sandy or loamy-textured soils, but are quite variable and also may include fine-textured soils. The dominant perennial bunchgrasses and shrubs within this community are all very drought-resistant plants. Dominant graminoid species include Indian ricegrass, three-awn species (*Aristida* spp.), blue grama, needle-and-thread grass, muhly species (*Muhlenbergia* spp.), and galleta grass and may include scattered shrubs and dwarf-shrubs of species of sagebrush, saltbush, Mormon tea, winterfat, and snakeweed species (*Gutierrezia* spp.). Altered and/or disturbed communities may have converted to invasive annual grasslands (also included in this category) and may include annual grass species such as oat species (*Avena* spp.), brome species (*Bromus* spp.), and Mediterranean grass species (*Schismus* spp.) (NRCS 2008a; USGS 2005).

3.11.1.4 Cliff/Canyon

The cliff/canyon vegetation cover type, as defined by the Colorado Plateau Mixed Bedrock Canyon and Tableland SWReGAP category, is comprised of barren and sparsely vegetated landscapes of steep cliff faces, narrow canyons, and open tablelands of sandstone, shale, and limestone. The vegetation is characterized by very open tree canopy or scattered trees and shrubs with a sparse herbaceous layer. Common species include piñon pine (*Pinus edulis*), ponderosa pine (*Pinus ponderosa*), juniper species, littleleaf mountain mahogany (*Cercocarpus intricatus*), and other short-shrub and herbaceous species, utilizing moisture from cracks and pockets where soil accumulates (NRCS 2008a; USGS 2005).

3.11.1.5 Riparian

Riparian vegetation is composed of a mosaic of tree-dominated or shrub-dominated species. This vegetation community is dependent on a natural hydrologic regime, especially annual or episodic flooding, occurring within floodplains, islands, sand or cobble bars, and immediate streambanks that support perennial (e.g., White and Green rivers) and intermittent waterbodies throughout the study area. Dominant species may include boxelder (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), quaking aspen (*Populus tremuloides*), eastern cottonwood (*Populus deltoides*), Fremont cottonwood (*Populus fremontii*), peachleaf willow (*Salix amygdaloides*), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), Drummond's willow (*Salix drummondiana*), narrowleaf willow (*Salix exigua*), silver buffaloberry (*Shepherdia argentea*), snowberry species (*Symphoricarpos* spp.), and sedge species (*Carex* spp.). Exotic species such as tamarisk (*Tamarix* spp.), tall white top (*Lepidium latifolium*), white top (*Lepidium draba*), and common reed (*Phragmites australis*) also are well established within this vegetation community (BLM 2008b; NRCS 2008a; USGS 2005).

3.11.1.6 Pinyon-juniper Woodland

Pinyon-juniper woodland is characterized as a lower elevational community of the Colorado Plateau occurring on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. This vegetation cover type occurs at slightly higher elevations than the sagebrush shrubland. Substrates supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay. Dominant overstory species include two needle pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Common understory species may include greenleaf manzanita (*Arctostaphylos patula*), basin big sagebrush (*Artemisia tridentata spp. tridentata*), mountain mahogany (*Cercocarpus* spp.), rabbitbrush species (*Chrysothamnus* spp.), winterfat, mormon tea

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T11S R24E
Green River
White River
Bitter Creek
Hill Creek
Willow Creek

Utah
Area of Detail
Uintah County

LEGEND

- Township/Range
- EIS Project Area
- Named Streams and Rivers
- Agriculture
- Barren
- Cliff/canyon
- Developed
- Grassland
- Piñon-juniper woodland
- Riparian
- Sagebrush shrubland
- Salt-desert shrubland

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1 0.5 0 1 2
Scale in Miles
2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.11-1

Vegetation Cover Types

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grasses such as Indian rice grass, Idaho fescue, and western wheatgrass, and forbs such as milkvetch species (*Astragalus* spp.) and wallflower (*Erysimum asperum*) (BLM 2008b; NRCS 2008a; USGS 2005).

3.11.1.7 Agriculture

Agricultural lands include both non-cultivated and cultivated croplands. Non-cultivated croplands consist of pasture/hay fields (i.e., areas of grasses, legumes, or grass-legume mixtures). In Utah, cultivated croplands consist of field crops such as spring and winter wheat, barley, beans, corn for grain and silage, alfalfa and grass hay, oats, onions, and potatoes (NRCS 1997).

The NRCS classifies croplands to identify the most suitable land for agriculture production. The categories include prime farmland and farmland of unique importance. Prime farmland is defined by NRCS as land that has the best combination of physical and chemical characteristics for producing crops and is available for crop production (NRCS 2009). Unique farmland is defined by NRCS as land other than prime farmland that is used for the production of specific high value food and fiber crops (NRCS 2009). Generally in Utah, croplands require irrigation to be considered prime farmland, while orchards make up most of the areas considered unique farmlands. Within Uintah County, all lands designated prime farmland are irrigated, and all unique farmlands are orchards. In the BLM Vernal Field Office area, there are no prime or unique farmlands (BLM 2008c). Additionally, there are no irrigated lands or orchards on BLM-administered lands within the GNBPA.

3.11.1.8 Barren

Barren lands are comprised of barren and sparsely vegetated landforms (i.e., rounded hills and plains that form a rolling topography). Substrates are often derived from siltstone and mudstone deposits resulting in an area characterized by high rates of erosion. Generally, vegetation such as dwarf-shrub and herbaceous species account for less than 10 percent of the total herbaceous cover.

3.11.1.9 Developed

Developed lands are characterized by housing units, parks, golf courses, and vegetation planted in development settings for recreation, erosion control, or aesthetic purposes. Impervious surfaces account for less than 20 percent of total cover.

3.11.2 Noxious Weeds and Invasive Species

A "noxious weed" is defined as any plant the Utah Department of Agriculture commissioner determines to be especially injurious to public health, crops, livestock, land, or other property per the Utah Noxious Weed Act (Utah State Legislature 2007). Noxious weeds have become a growing concern in the western U.S. based on their ability to increase in cover relative to surrounding vegetation and exclude native plants from an area. The spread of noxious weeds has resulted in substantial economic impacts on some sectors of the State of Utah. As a result, the State has enacted laws requiring the control of noxious weed species (Utah State Legislature 2007). In addition, the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974) and EO 13112 of February 3, 1999, require cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. Recognizing these regulations, the BLM established a goal that NEPA documents consider and analyze the potential for the spread of noxious weed species and provide preventative rehabilitation measures for each management action involving surface disturbance.

Table 3.11-2 provides a list of designated noxious weed species and priority species as identified by the State of Utah, the Uintah County Weed Board, and the BLM Vernal Field Office. For the BLM, the invasive species of most concern and a priority for management and control are Russian knapweed, spotted knapweed, Canada thistle, tall whitetop, musk thistle, Scotch thistle, and leafy spurge (BLM 2008c). On native rangelands, black henbane and houndstongue are of concern, while Russian thistle, halogeton, and cheatgrass tend to increase in association with oil field development (BLM 2008c). Tamarisk is found in riparian areas and moist areas in the desert shrub and sagebrush/grass communities (BLM 2008c). Russian thistle, halogeton, and cheatgrass have been observed in the GNBPA (BLM 2006b,c).

Table 3.11-2 Designated Noxious Weeds and Invasive Species Potentially Occurring Within the GNBPA

Common Name[1]	Scientific Name[1]	State of Utah Noxious Weed List[2]	Uintah County Noxious Weed List[3]	BLM Vernal Field Office Other Invasive Species of Concern[4]
Velvetleaf	*Abutilon theophrasti*	--	--	X
Russian knapweed	*Acroptilon repens*	X	X	X
Jointed goatgrass	*Aegilops cylindrical*	--	--	X
Common burdock	*Arctinum minus*	--	--	X
Downy brome	*Bromus tectorum*	--	--	X
Whitetop	*Cardaria draba*	X	X	X
Plumeless thistle	*Carduus acanthoides*	--	--	X
Nodding plumeless thistle	*Carduus nutans*	X	X	X
Diffuse knapweed	*Centaurea diffusa*	X	X	X
Spotted knapweed	*Centaurea maculosa*	X	X	X
Meadow knapweed	*Centaurea pratensis*	--	--	X
Yellow starthistle	*Centaurea solstitialis*	X	X	X
Squarrose knapweed	*Centaurea virgata* ssp. *squarrosa*	X	X	--
Oxeye daisy	*Chrysanthemum leucanthemum*	X	--	X
Chicory	*Cichorium intybus*	--	--	X
Canada thistle	*Cirsium arvense*	X	X	X
Bull thistle	*Cirsium vulgare*	--	--	X
Poison hemlock	*Conium maculatum*	X	--	X
Field bindweed	*Convolvulus arvensis*	X	X	X
Bermudagrass	*Cynodon dactylon*	X	X	--
Houndstongue	*Cynoglossum officinale*	X	--	X
Common teasel	*Dipsacus fullonum*	--	--	X
Russian olive	*Elaeangus angustifolia*	--	X	X
Quackgrass	*Elymus repens*	X	X	--
Redstem filaree	*Erodium cicutarium*	--	--	X
Leafy spurge	*Euphorbia esula*	X	X	X
Halogeton	*Halogeton glomeratus*	--	--	X
Venice mallow	*Hibiscus trionum*	--	--	X
Black henbane	*Hyoscyamus niger*	X	--	X
Dyers woad	*Isatis tinctoria*	X	X	--
Perennial pepperweed	*Lepidium latifolium*	X	X	X
Dalmation toadflax	*Linaria dalmatica*	X	--	X
Yellow toadflax	*Linaria vulgaris*	X	--	X
Purple loosestrife	*Lythrum salicaria*	X	X	--
Scotch thistle	*Onopordum acanthium*	X	X	X
Sulfur cinquefoil	*Potentilla recta*	X	--	X
Perennial sowthistle	*Sonchus arvensis*	--	--	X
Perennial sorghum	*Sorghum almum*[5]	X	X	--

Table 3.11-2 Designated Noxious Weeds and Invasive Species Potentially Occurring Within the GNBPA

Common Name[1]	Scientific Name[1]	State of Utah Noxious Weed List[2]	Uintah County Noxious Weed List[3]	BLM Vernal Field Office Other Invasive Species of Concern[4]
Johnsongrass	*Sorghum halepense*	X	X	--
Medusahead	*Taeniatherum caput-medusae*	X	X	--
Saltcedar	*Tamarix ramosissima*	X	X	X
Common tansy	*Tanacetum vulgare*	--	--	X
Puncturevine	*Tribulus terrestris*	--	--	X
Common mullein	*Verbascum thapsus*	--	--	X

-- = Species not classified as noxious or invasive per the cooperating agency.

[1] Species nomenclature is consistent with the NRCS Plants Database (NRCS 2008a).

[2] Officially designated and published as "noxious" for the State of Utah (Utah State Legislature 2007; Utah Administrative Code 2008a). All property owners and custodians of public land are required by Law (4-17-7) to control weeds on lands under their jurisdiction.

[3] Designated as "noxious" in Uintah County (Uintah County Weed Department 2008).

[4] Species designated as a priority species per the BLM Vernal RMP (BLM 2008b) including species known to occur in Rio Blanco County, Colorado (abutting Uintah County, Utah).

[5] Species designated as a "noxious" for the State of Utah; however, this species is not designated as a noxious weed species per the Utah Weed Control Association (2008).

Control methods consist of chemical and mechanical measures, as well as habitat manipulation programs for cheatgrass infested areas (BLM 2008c). The BLM Vernal Field Office Surface Disturbing Weed Policy (BLM 2009b) outlines the goals of the current weed management program, which are prevention, early detection and rapid response, control and management, reclamation, and organizational collaboration. A key focus of the program is the incorporation of an integrated pest management approach into weed control and management activities. This would include the full range of integrated pest management techniques including prevention, detection, cultural control, physical control, biological control, chemical control, fire treatment, revegetation, and monitoring. The specific prevention and control techniques employed would be determined on a site-specific basis.

3.11.3 Special Status Plant Species

Special status plant species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species that are protected under the ESA, or are considered as candidates for such listing by the USFWS, species that are state listed as threatened or endangered, BLM sensitive species, and species classified as Utah species of special concern.

In accordance with the ESA, as amended, the lead agency in coordination with the USFWS must ensure that any federal action to be authorized, funded, or implemented would not adversely affect a federally listed threatened or endangered species or its critical habitat. The BLM Special Status Species Management Policy 6840 requires the BLM to manage and protect any USFWS candidate species, state sensitive species, or State of Utah species of concern to prevent the need for future federal listing as threatened or endangered.

Information regarding special status plant species occurrence and habitat within the GNBPA was obtained from a review of existing published sources; GIS data from the BLM, Utah Natural Heritage Program (UNHP), and Grassland Consulting Inc. (Grasslands) APD survey results; the BLM Vernal RMP (BLM 2008c); and USFWS file information. Other GIS data resources used to identify potential habitat characteristics were obtained from the UGS, the NRCS SSURGO and STATSGO databases, and SWReGAP.

A total of 21 special status plant species (5 federally listed species, 1 federal candidate species, and 15 BLM sensitive species) were identified by the USFWS (USFWS 2007b) as potentially occurring within Uintah

County, Utah. These species, their associated habitats, and potential for occurrence within the GNBPA are summarized in **Appendix H**. For this document, habitat was classified in three categories:

- Potential habitat – areas within the geographic range of this species that have been identified as potentially having habitat characteristics based on a desktop analysis of GIS data for the area;
- Suitable habitat – areas that have been field verified as having habitat characteristics even though no species were observed; and
- Occupied habitat – areas where the species has been identified by field surveys.

Occurrence potential within the study area was evaluated for each of these species based on their habitat requirements and/or known distribution. Based on these evaluations, 18 species have been eliminated from detailed analysis as their known range is outside of the GNBPA. Rationale for eliminating the species from additional analysis is provided in **Appendix H**. The species eliminated from further analysis include alcove bog-orchid, Barneby ridge-cress, Duchesne green-thread, Gibbens beardtongue, Goodrich's blazingstar, Goodrich's cleomella, Goodrich penstemon, Hamilton milkvetch, Huber's pepperweed, Ownbey thistle, Pariette hookless cactus, park rockcress, rock hymenoxys, shrubby reed-mustard, stemless penstemon, Untermann daisy, Ute ladies'-tresses orchid, and White River beardtongue. Of the remaining 3 species that are analyzed in detail, two are federally listed (Uinta Basin hookless cactus and Clay reed-mustard) and one is a BLM sensitive species (Graham's beardtongue). These species are discussed below.

3.11.3.1 Graham's Beardtongue

Graham's beardtongue is a BLM sensitive species and a member of the figwort family. It is an endemic plant species restricted to the Uinta Basin in Carbon, Duchesne, and Uintah counties, Utah; and in adjacent Rio Blanco County, Colorado.

The USFWS published a proposed rule (January 19, 2006) to determine whether Graham's beardtongue should be listed as threatened under the ESA (USFWS 2006a) and to designate critical habitat for the species. The proposed rule was subsequently withdrawn on December 19, 2006 (USFWS 2006b). This decision was based on existing BLM policies, land use plans, and on-the-ground protective measures provided to the USFWS during the public comment period on the proposed rule (BLM 2008f).

Graham's beardtongue is an herbaceous, small-statured, perennial herb between 2 to 8 inches tall, emerging from a branched taprooted caudex. The species has leathery leaves and large, light- to deep-colored tubular lavender flowers that develop in late May and early June. It is distinct from other Uinta Basin penstemon species (*Penstemon spp.)* by its large, deep lavender corollas (1 to 1.5 inches long) with dark violet lines in the throat and staminode conspicuously exserted and bearded with golden orange hairs. Several species of native bees and wasps, including the solitary pollen wasp (*Pseudomasaris vespoides*), are known to visit this species' flowers, collecting only nectar and pollen for themselves and their progeny (Utah Rare Plants 2006; BLM 2008f).

The species commonly inhabits sparsely vegetated desert shrub and pinyon-juniper communities consisting of shadscale, horsebrush, ryegrass, buckwheat, and pinyon-juniper species. Typical habitat consists of exposed, raw shale ledges, knolls, and slopes derived from the Parachute Creek and Evacuation Creek members of the Green River Formation between 4,600 to 6,700 feet elevation (Utah Native Plant Society [UNPS] 2009; BLM 2008f).

Based on The Center for Native Ecosystems, approximately 36 Graham's beardtongue populations are known to occur within its range (BLM 2008f). Of these 36 populations, nine populations are composed of less than 10 individuals. Although populations have been documented in east Duchesne and Uintah counties, Utah, no known populations have been identified within the GNBPA. Potential habitat is located in the southwest corner of the GNBPA, where 121 acres of the Parachute Creek Member of the Green River Formation occur.

3.11.3.2 Clay Reed-mustard

The clay reed-mustard (*Schoenocrambe argillacea*) was listed as federally threatened on January 14, 1992 (USFWS 1992). A member of the mustard family, it is endemic to the Uinta Basin in Uintah County, Utah. The species was first discovered in the southern portion of the Uinta Basin in 1976 (USFWS 1994). Initially described as *Thelypodiopsis argillacea,* the species was moved to the genus *Schoenocrambe* by R.C. Rollins in 1982 (USFWS 1994).

Clay reed-mustard is a herbaceous hairless perennial with a stout woody base (UDWR 2008a; USFWS 1994). Sparsely leafed stems grow 6 to 12 inches tall, with narrow, smooth margined alternate leaves (NatureServe 2009; USFWS 1994). The leaves are sessile and very narrow, usually less than 0.1-inch wide. The leaves are somewhat thickened with acute to rounded apices. The flowers are white to lilac with prominent purple veins (NatureServe 2009). The flowers are in a terminal raceme of 3 to 20 flowers, and each flower is approximately 0.4-inch long (USFWS 1994). The sepals are violet with translucent margins. The fruit is a silique, approximately 0.7 to 0.9 inch long, and usually curved.

Not much is known about the specific pollinators or pollination mechanism of the clay reed-mustard. It flowers from late April to early May (NatureServe 2009) and fruits from May to June (USFWS 1994). Seed dispersal vectors are unknown but could include wind, animal, or mechanical methods. Very little is known about factors affecting its distribution, long-term population dynamics, and seed and seedling biology.

Clay reed-mustard is often found on north facing slopes, often in steep and inaccessible sites. Populations occur on shales at the contact zone between the lower Uinta and upper Green River Formations (BLM 2008c). It is found on substrates of surface bedrock, scree, and fine-textured soils (UDWR 2008a). The plant prefers soils of clayey sand derived from shales and sandstones and is usually found in mixed desert shrub communities of Indian ricegrass (*Achnatherum hymenoides*) and pygmy sagebrush (*Artemisia pygmaea*) between 4,800 and 5,600 feet above mean sea level (amsl) (UNPS 2006). Other associated species include Utah serviceberry (*Amelanchier utahensis*), Western wheatgrass (*Pascopyrum smithii*), beautiful rockcress (A*rabis pulchra*), black sagebrush (*Artemisia nova*), Gardner's saltbush (A*triplex gardneri*), and saline wildrye (*Leymus salinus*).

There are a total of approximately 6,000 individuals across all known populations in Uintah County (USFWS 1994). The species is known to occur from Willow Creek to Sand Wash along the Evacuation Creek member of the Green River Shale Formation (BLM 2008c). Within the GNBPA, the species has been documented in the southwest corner of the GNBPA, where it is limited to cliff habitats within an approximately 332-acre area (Grasslands 2008a,b). Suitable habitats and known populations have not been documented in other portions of the GNBPA.

3.11.3.3 Uinta Basin Hookless Cactus

The Uinta Basin hookless cactus (*Sclerocactus wetlandicus*) has a complicated taxonomic history. Based on populations observed in Colorado in 1898 by Karl Schumann, it was originally described as *Echinocactus glaucus* (USFWS 1990). In 1917, Rydberg re-named it *E. subglaucus,* and in 1925, Purpus assigned it to *S. whipplei* var. *glaucus.* In 1939, Evans described it as *S. franklinii.* This is now considered a synonym. In 1966, Lyman Benson grouped 6 species under the genus *Sclerocactus,* assigning the Uinta Basin hookless cactus *S. glaucus*. In 1972, Arp reassigned all the species under the genus *Sclerocactus* to the genus *Pediocactus,* and in 1981, Heil, Armstrong, and Schleser restored the species back to the genus *Sclerocactus* and re-established *S. glaucus* (BLM 2005). When the species was listed as a threatened species on October 11, 1979 (USFWS 1979), it was listed under Benson's nomenclature. In 1989, Fritz Hochstatter described a subspecies, *S. wetlandicus* var. *ilsea*, as a short-spined subspecies of *S. glaucus* found in northeast Utah around the Pariette Wetlands. In 1994, Heil and Porter in renamed this subspecies as *Sclerocactus brevinspinus*, which they described as having globose stems, short spines, and small flowers. Preliminary chloroplast DNA studies further confirmed the taxonomic separation between the *sclerocactus* species (BLM 2005).

In 1997, the USFWS determined that *S. brevispinus* has legal protection as a threatened species under the 1979 listing of *S. glaucus* (USFWS 1997). However, on September 18, 2007, a further change in the taxonomy of *S. glaucus* was submitted to the Federal Register, which split the "Uinta Basin hookless cactus complex" into three species based on the many studies, field surveys, and garden experiments reevaluating morphological characteristics and genetic profiles (USFWS 2007c). These three subspecies include *S. glaucus*, *S. wetlandicus*, and *S. brevispinus*. In this September 18, 2007, Federal Register notice, the USFWS states that *S. glaucus* is endemic to western Colorado, and while originally referred to as the Uinta Basin hookless cactus, it is now referred to as the Colorado hookless cactus. The Pariette cactus (*S. brevispinus*) has been found to be morphologically unique from the other two species. The Uinta Basin hookless cactus (*S. wetlandicus*) is considered a separate population from the Colorado hookless cactus and morphologically unique from Pariette cactus. All three subspecies are considered federally threatened under the 1979 listing of *S. glaucus*. On October 15, 2009, the USFWS announced the recognition of the three *sclerocactus* species as distinct species. Each species is still considered threatened under the ESA (USFWS 2009a)

The Uinta Basin hookless cactus is a perennial, solitary ovoid or cylindrical cactus. A member of the cactaceae family, it is usually unbranched and grey to grey-green in color. Each plant generally has 12 vertical ribs with spine clusters (aeroles) along the ribs. At each areole, there are 1 to 4 central spines that are white to grey colored and 4 to 12 finer radial spines. The central spines are distally hookless (though they can sometimes be slightly hooked) and stand erect from the aerole center. The central spines are 0.7 to 1.6 inches long, while the radial spines are 0.2 to 0.7 inch long and needlelike. The flowers are 1 to 2 inches long and composed of numerous pinkish to lavender perianth parts (sepaloids and petaloids). The sepaloids and petaloids range in color from green to lavender to magenta. The numerous stamens have filaments ranging from green to white and yellow anthers. The ovary is inferior. The barrel shaped fruit is brown with a few membranous scales mostly near the apex and ranges in size from 0.3 to 0.5 inch. The seeds are small, black, and flattened apically.

The Uinta Basin hookless cactus flowers late April to May, and fruits in June and July (Heil and Porter 2003; USFWS 1990). Observed pollinators include bees, beetles, ants, and flies. Once the pericarp separates horizontally near its base, a "cup of seeds" is left to disperse. Seed dispersal vectors include gravity, ants, birds, rodents, precipitation, and surface water flows. It is theorized that seed dispersal is a limiting factor in the distribution of the species (USFWS 1990). Very little is known about the factors affecting the distribution and long-term population dynamics of the Uinta Basin hookless cactus.

The threats to the all three *sclerocactus* cactus species listed in the Recovery Plan (USFWS 1990) include illegal collecting, mineral and energy development activities, off-road vehicle use and recreational impacts, road building and maintenance, water development, and pesticide use. Currently, the Uinta Basin hookless cactus is facing many of the same threats, with habitat loss/modification and fragmentation as the top concern. Habitat is being lost or modified due to energy development activities, water storage projects, and transportation projects. Other threats to the cactus include plant collecting, damage to individuals and populations from off-road vehicle use and recreation activities, and pesticide use.

Information on the habitat requirements and distribution of this species has been rapidly changing as more studies and surveys are conducted in the Uinta Basin. Currently, it is known to occur on Quaternary and Tertiary alluvium soils overlain with cobbles and pebbles of the Duchesne River, Green River, and Mancos Formations between 4,500 to 6,600 feet amsl (BLM 2008c; UNPS 2006). It is found on the gravelly hills and terraces on river benches, valley slopes, and rolling hills along the Green, White, and Duschesne rivers. Preferred habitat seems to be on Pleistocene outwash terraces with coarse-textured, alkaline soils overlain by a surficial pavement of large, smooth, rounded cobble. It can be found in a range of vegetative communities including clay badlands, salt desert shrub, and pinyon-juniper. Associated species include black sagebrush, shadscale saltbush (*Atriplex confertifolia*), James' galleta (*Pleuraphis jamesii*), and Indian ricegrass.

The GNBPA occupies a majority portion of the Uinta Basin hookless cactus known habitat. Within the GNBPA, the species has been observed along Willow Creek, Cottonwood Wash, and within approximately 2 miles of

the White River. These populations have been observed in typical alluvial habitats and atypical habitats including, sandstone ledges, angular shale, cryptobiotic soils, and mudstone. Based on information provided by UNHP and surveys conducted by Grasslands (Grasslands 2008a,b), Uinta Basin hookless cactus occurs in approximately 1,500 to 2,000 locations within and immediately adjacent to the GNBPA. These populations are well represented within the previously known locations and have been documented beyond the extent of known populations as identified in the 1990 Recovery Plan for the Uinta Basin Hookless Cactus (USFWS 1990).

GIS evaluation of known locations, their associated soil types, and distance to the White River, Green River, Willow Creek, Cottonwood Wash, and Sand Wash was used to identify potential habitat areas where the core populations of the species are found. Although populations can be found outside of these areas, they tend to be more isolated and occur in much lower densities.

Soil types associated with known occurrences of the species in the GNBPA include Badland-Rock outcrop complex on 1 to 100 percent slopes, Badland-Tipperary association on 1 to 8 percent slopes, Cadrina extremely stony loam-Rock outcrop complex on 25 to 50 percent slopes, Jenrid sandy loam on 0 to 2 percent slopes, Casmos-Cadrina-Badland complex on 4 to 25 percent slopes, Muff-Cadrina cool association on 1 to 25 percent slopes, Cadrina-Casmos-Rock outcrop complex on 2 to 40 percent slopes, and Motto-Casmos complex on 2 to 25 percent slopes. Potential habitat was mapped to include these soil types within 2 miles of the streams and rivers listed above. As soil data was unavailable for the area owned by the Ute tribe, habitat was mapped by using only known location data and proximity to the White River and Cottonwood Wash.

Based on this habitat modeling, approximately 54,618 acres of potential habitat for the Uinta Basin hookless cactus is located within the GNBPA.

3.12 Visual Resources

The study area for the proposed project is defined as the viewshed of the project, or the area from which the project can be seen. The viewshed includes an area bounded by foothills and ridges on the east and north and less well-defined topographic rises to the south and west of the project site.

The proposed project is located in the Colorado Plateau Physiographic Province, as defined by Fenneman (1931). The province is characterized by extensive vistas, plateaus, buttes, mesas, and deeply incised canyons exposing flat-lying or gently warped strata. The White River and associated landforms are the predominant landscape features of the region. The confluence of the White River and Green River is situated at the northwest corner of the GNBPA.

The visual resources of the area are comprised of gentle to steep landforms. Vegetation consists of salt-desert shrubland, sagebrush shrubland, pinyon-juniper woodland, grassland, riparian, and barren lands. Vegetation colors in the growing season range from silvery gray-green to medium olive and during the dormant seasons vegetation ranges from silvery gray-green of shrubs to tan, buff, umber and gold of grasses and forbs, to gray-green and dark olives of tree patterns. Grey, brown, and umber indicate areas of sparse vegetation, soil, and rocks.

The GNBPA is visible from rafting, hunting, and fishing recreation areas. The topography is moderately to extremely steep sloping. The GNBPA is situated at an elevation ranging from approximately 4,650 to 6,000 feet. Surface soils and rocks in the vicinity generally range from dark umber to buff to grayish-tan hues of light-to-medium-to-dark values.

The existing and approved development pattern of oil and gas-related structures, well pads, and roads exhibits moderate to strong color and landform contrast with the natural surroundings and moderate line and surface texture contrast. The browns, light tans and gold of the recently disturbed sites stand out moderately to strongly in comparison with the surrounding natural landforms and vegetation. Structures in the visual area of influence are limited mainly to industrial forms, colors, and characters.

3.12.1 Visual Resource Management Classification

The BLM is responsible for identifying and protecting scenic values on public lands under several provisions of the FLPMA and NEPA. The BLM VRM system was developed to facilitate the effective discharge of that responsibility in a systematic, interdisciplinary manner. The VRM system provides the methodology to inventory existing scenic quality; assign visual resource inventory classes based on a combination of scenic values, visual sensitivity, and viewing distances; and assign visual management objectives. Four visual resource classes have been established to 1) serve as an inventory tool portraying the relative value of existing visual resources; and 2) serve as a management tool portraying visual management objectives for the respective classified lands. Management objectives for each of the visual resource classes are listed as follows:

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

activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

- **Class IV Objective**. The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The VRM system also includes a contrast rating procedure for evaluating the potential visual consequences of a proposed project or management activity. The VRM system provides the basic approach for evaluating direct visual impacts as well as potential cumulative visual impacts of the proposed project.

The BLM Vernal Field Office considers surface-disturbing activities, including minerals exploration and development, OHV use, and road development as the primary activities that could potentially cause visual intrusions and impact scenic quality.

The BLM has identified three VRM Classes within the GNBPA: Class II, Class III, and Class IV (**Figure 3.12-1**). Class II and III are designated within the White River viewshed and Class IV is designated throughout the rest of the landscape. The GNBPA is within standards of Class III and Class IV objectives. This visual area of influence is the basis for estimating aesthetic consequences of the proposed project in the landscape. The basic elements of landscape (form, line, color, and texture) are utilized for analyzing detailed landscape character in the affected environment.

The BLM has identified two areas within the GNBPA from which existing and proposed modifications to the landscape would be readily visible to recreationists, hunters, campers, and other visitors to the area. These areas are the White River and the Goblin City Overlook. **Figure 3.12-2** shows the viewshed from the centerline of the White River and the viewshed from the Goblin City Overlook within a 5-mile radius. Within the GNBPA, an estimated 44,369 acres are visible from the centerline of the White River and 4,836 acres are visible within 5 miles of the Goblin City Overlook.

T4S R3E
T5S R3E
T8S R20E
T8S R21E
T8S R22E
T8S R23E
T8S R24E
T9S R20E
T9S R21E
T9S R22E
T9S R23E
T9S R24E
T10S R20E
T10S R21E
T10S R22E
T10S R23E
T10S R24E
T11S R20E
T11S R21E
T11S R22E
T11S R23E
T11S R24E
Green River
Green River
White River
Bitter Creek
White River
Hill Creek
Willow Creek
Willow Creek
Utah
Uintah County
Area of Detail

Legend

- EIS ProjectArea
- Township/Range
- Named Streams and Rivers

Visual Resource Management Classification

- 2
- 3
- 4

N

Scale in Miles: 1 0.5 0 1 2

Scale in Kilometers: 2 1.5 1 0.5 0 2

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.12-1

Visual Resource Management Classes

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T4S R3E
T5S R3E
T8S R20E
T8S R21E
T8S R22E
T8S R23E
T8S R24E
T9S R20E
T9S R21E
T9S R22E
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T10S R22E
T10S R23E
T10S R24E
T11S R20E
T11S R21E
T11S R22E
T11S R23E
T11S R24E
Green River
Green River
White River
Bitter Creek
White River
Hill Creek
Willow Creek
Willow Creek

Utah
Area of Detail
Uintah County

Legend

- EIS ProjectArea
- Township/Range
- Goblin City Overlook
- Named Streams and Rivers
- Visibility from the White River
- Visibility from Goblin City Overlook

N

1 0.5 0 1 2
Scale in Miles
2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.12-2

Visibility from White River and Goblin City Overlook

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3.13 Water Resources

The study area for water resources is defined as the GNBPA. The following section presents resource definitions, applicable regulations, regulatory coordination, and affected environment resources for floodplains, waters of the U.S., and wetlands for the study area.

3.13.1 Surface Water

3.13.1.1 Surface Water Quantity

The GNBPA is located in the lower White River Basin, an area of semi-arid mesas and plateaus that have been deeply dissected by drainages. Major streams in the area include the White River, Bitter Creek, Asphalt Wash, Coyote Wash and its tributaries, Sand Wash, and Cottonwood Wash. The Green River is located immediately downstream of the GNBPA (**Figure 3.13-1**). The drainage areas for selected streams in the study area are shown in **Table 3.13-1**.

Table 3.13-1 Drainage Areas of Selected Streams

Stream or River	Drainage Area (square miles)
Asphalt Wash near mouth, near Watson, Utah	97.5
Bitter Creek at mouth, near Bonanza, Utah	398
Cottonwood Wash at mouth, near Ouray, Utah	70.6
Coyote Wash near mouth, near Ouray, Utah	228
Sand Wash near mouth, near Ouray, Utah	71.1
White River near Watson, Utah	4,020
White River at mouth, near Ouray, Utah	5,120

Source: Boyle et al. 1984.

Rainfall in the study area is limited. Average annual precipitation at Ouray and Bonanza is about 6.8 inches and 8.9 inches, respectively (Western Regional Climate Center 2007b). Snow accumulates at higher elevations to the south and north, and snowmelt provides most of the streamflow through the area. Thunderstorms also provide short-term runoff that causes more localized streamflow (Lindskov and Kimball 1984a). Evaporation from shallow lakes in the region is between 25 and 35 inches per year (Utah State University 1996). As a result of high evaporation rates, seepage into streambeds, and water uptake by plants or other users, the duration of flow in most channels is limited to the period of spring runoff.

A few larger streams do exhibit year-round flows. Perennial streams within the GNBPA include the White River and Bitter Creek. Most reaches of the other channels are ephemeral, flowing only in response to storm runoff or snowmelt. Some streams (e.g., Coyote Draw and Sand Wash) typically flow intermittently in their downstream reaches near the White River (National Water Information System [NWIS] 2007; Lindskov and Kimball 1984a). Along the intermittent reaches, seasonal flows are provided by ground water seeping into the stream channels for part of the year. No springs have been identified in the GNBPA, except for 1 mapped in the Bitter Creek channel bed about 2 miles upstream from the mouth of the creek (Utah Board of Water Resources 1999; Holmes and Kimball 1987). This spring is believed to be caused by upward leakage from the Bird's Nest Aquifer through the overlying Uinta Formation and into the stream alluvium. It flows relatively constantly at about 580 acre-feet per year (Holmes and Kimball 1987). This is equivalent to a flow rate of about 0.8 cubic feet per second, or approximately 360 gallons per minute. As such, this is a significant spring within the GNBPA.

Streamflows within the GNBPA and outside it vary considerably due to rainfall, irrigation withdrawals, evapotranspiration rates, and other factors. Surface water resources are hydrologically connected both within and beyond the GNBPA. In some ways, surface water systems may be thought of as a circulatory system or as rush-hour traffic, where conditions at one point can affect other parts of the system at some distance.

Because of this, available data both inside and outside the delineated project boundaries have been used to better understand surface water resources in the area.

Flows in the White River were measured by the USGS in the vicinity of Watson, Utah, (upstream near the Utah-Colorado state line) and downstream near the river mouth near Ouray, Utah. The common period of data at these gages is limited by the Ouray gage, and extends from April 1974 to September 1986. Upstream, the mean annual flow in the Watson area for the period was approximately 813 cubic feet per second. Mean monthly flows there ranged from a January low of 373 cubic feet per second to a high in June of 2,395 cubic feet per second. Downstream, the average annual river flow near Ouray was about 838 cubic feet per second. Mean monthly flows there ranged from a January low of 382 cubic feet per second to a high of 2,390 cubic feet per second in June (NWIS 2008).

These data generally indicate that, although there is an increase in watershed area of over 25 percent between the gages (**Table 3.13-1**), there has been little difference in the average monthly or annual flows from upstream to downstream in the project region. This likely is due to irrigation withdrawals and high evapotranspiration rates in the area. In addition, the arid or semi-arid conditions contribute relatively little precipitation and runoff when compared to the more mountainous areas in the upper White River watershed.

Flows in the smaller perennial streams, such as Willow Creek and Bitter Creek, are considerably less than those in the White River. Bitter Creek typically has flows of less than 5 cubic feet per second. Flows in Willow Creek vary widely, but generally range between 5 and 50 cubic feet per second. When present, flows in smaller streams such as Sand Wash, Cottonwood Wash, and Coyote Wash are highly variable but typically less than 5 cubic feet per second (NWIS 2007). However, flows in these tributaries may exceed 100 cubic feet per second during spring runoff or storm events.

Under normal conditions for the White River at its mouth near Ouray, a flow of 410 cubic feet per second is equaled or exceeded 50 percent of the time. A flow of 570 cubic feet per second is equaled or exceeded 25 percent of the time, and a flow of 1,400 cubic feet per second is equaled or exceeded 10 percent of the time at that location (Boyle et al. 1984). These values do not reflect potential flood events, but they do give an indication of flows that normally can be expected to occur on the river. Maximum flow rates that occur under flood conditions would be greater, but less frequent.

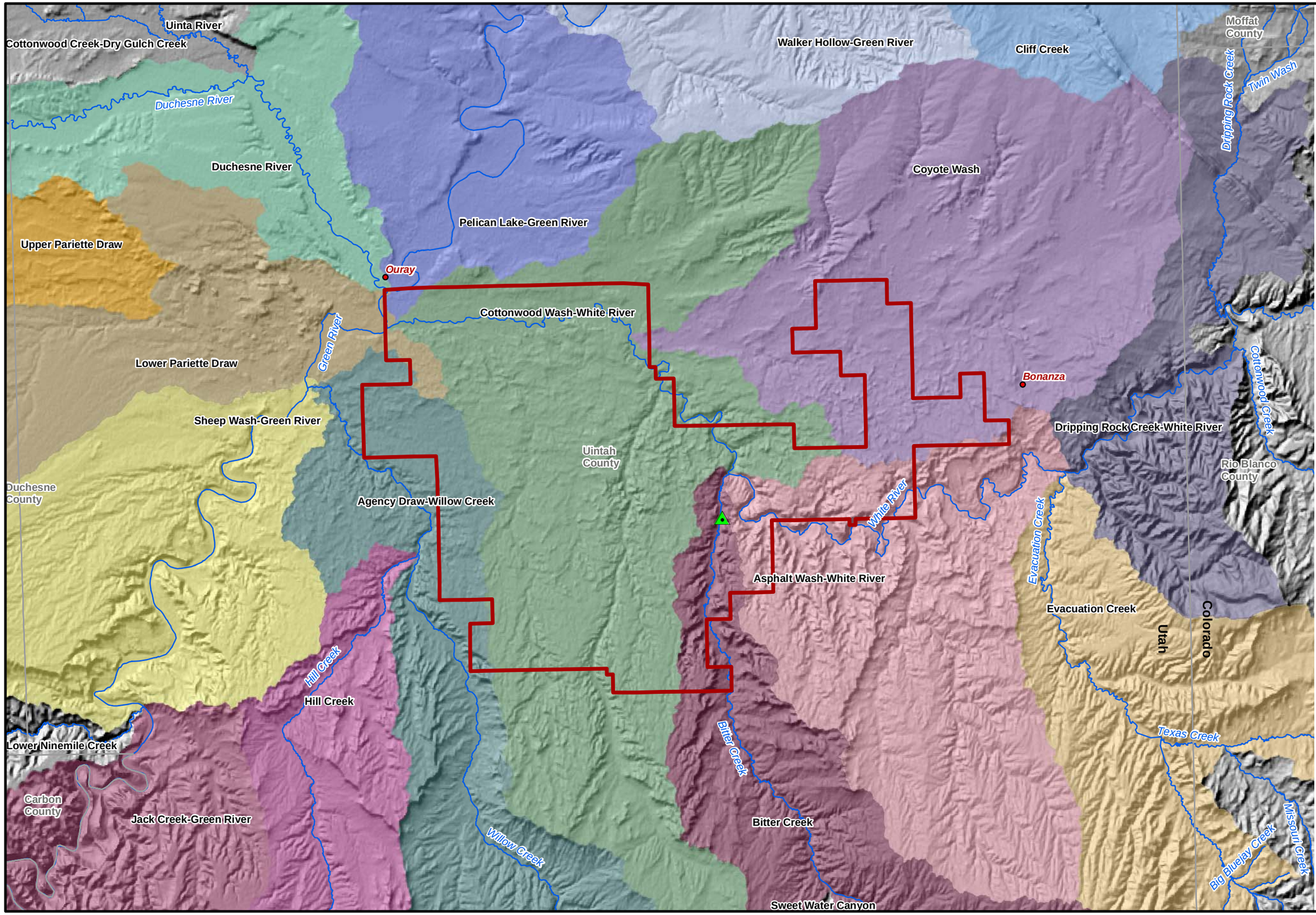
3.13.1.2 Flood Hydrology

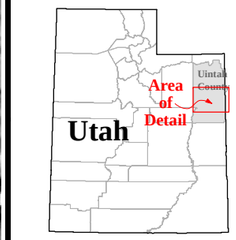
Floods in small watersheds in the semi-arid West often result from localized, intense summer thunderstorms. Rainfall estimates for such events in the study area are shown in **Table 3.13-2**.

Table 3.13-2 Precipitation-Frequency-Duration Values for the Study Area

Frequency and Duration of Rainfall	Expected Precipitation Amount at Ouray (inches)	Expected Precipitation Amount at Bonanza (inches)
10 year, 6-hour	0.95	1.06
10-year, 24-hour	1.39	1.46
25-year, 1-hour	0.87	0.98
25-year, 6-hour	1.17	1.30
25-year, 24-hour	1.68	1.76
100-year, 1 hour	1.32	1.46
100-year, 6 hour	1.58	1.74
100-year, 24-hour	2.15	2.25

Source: National Oceanic and Atmospheric Administration 2009.





Legend

- City or Town
- EIS Project Area
- Recorded Spring Location (Holmes and Kimball 1987)
- Named Streams and Rivers

Hydrologic Units

- Agency Draw-Willow Creek
- Asphalt Wash-White River
- Bitter Creek
- Cliff Creek
- Cottonwood Wash-White River
- Coyote Wash
- Dripping Rock Creek-White River
- Duchesne River
- Evacuation Creek
- Hill Creek
- Jack Creek-Green River
- Lower Pariette Draw
- Pelican Lake-Green River
- Sheep Wash-Green River
- Upper Pariette Draw
- Walker Hollow-Green River

N

1.5 0.75 0 1.5 3 4.5
Scale in Miles

2 1.5 1 0.5 0 2 4 6
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.13-1

Major Watersheds

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Small storms would produce no runoff at all; the rainfall would be entirely absorbed by the land surface. In contrast, large storms may produce substantial splash erosion, suspended sediment, and flash flooding. Storm intensity actually may be greater in shorter-duration events, as can be surmised by comparing the 100-year, 1-hour, or 6-hour precipitation amounts to the 100-year, 24-hour amount. Although shorter, these large, intense storms can still cause substantial runoff, erosion, and flood damage.

Annual peak flows on the White River and smaller channels in the study area have been studied by previous investigators (Lindskov and Kimball 1984a). Based on their analyses, a peak flow of approximately 4,100 cubic feet per second can be expected to occur on the White River every 2 years (a 50-percent chance in any year). A peak flow of approximately 6,300 cubic feet per second can be expected on a 10-year recurrence interval, or in approximately 10 percent of the years. In any given year, there is a 1 percent chance that a peak flow of approximately 9,000 cubic feet per second could occur. As a long-term average then, this would be the 100-year flood on the White River. Of the historical peak flows on the White River near Watson, about 60 percent resulted from snowmelt runoff and about 40 percent resulted from thunderstorms.

Based on work by Lindskov and Kimball (1984a), **Table 3.13-3** shows the mean annual peak flow for smaller drainages in the study area. These values represent the largest flow that is most likely to happen during any given year. These estimates are based on historical flow measurements that provide a statistical relationship to the drainage area of the smaller streams.

Table 3.13-3 Mean Annual Peak Flow for Smaller Streams, Cubic Feet per Second

Stream	Mean Annual Peak Flow
Asphalt Wash near mouth, near Watson, Utah	273
Bitter Creek at mouth, near Bonanza, Utah	1,114
Cottonwood Wash at mouth, near Ouray, Utah	198
Coyote Wash near mouth, near Ouray, Utah	638
Sand Wash near mouth, near Ouray, Utah	199

The values in **Table 3.13-3** do not represent higher flood flows that may recur at various intervals (e.g., a 100-year flood). The maximum values for those events are presented in **Table 3.13-4**. These estimates are based on other watershed approximations developed by Lindskov and Kimball (1984a) for the study area.

Table 3.13-4 Estimated Flood Flows for Smaller Streams, Cubic Feet per Second

Stream	10-Year Flood Peak[1]	25-Year Flood Peak[1]	100-Year Flood Peak[1]
Asphalt Wash near mouth, near Watson, Utah	1,200	2,000	4,100
Bitter Creek at mouth, near Bonanza, Utah	4,900	8,400	16,700
Cottonwood Wash at mouth, near Ouray, Utah	900	1,500	3,000
Coyote Wash near mouth, near Ouray, Utah	2,800	4,800	9,600
Sand Wash near mouth, near Ouray, Utah	900	1,500	3,000

[1] The 10-year flood has a 10 percent chance of occurring in any given year; the 25-year flood has a 4 percent chance of occurring in any given year; and the 100-year flood has a 1 percent chance of occurring in any given year.

There are no significant impoundments in the GNBPA, other than an existing series of industrial ponds along Kennedy Draw and Antelope Draw. These ponds do not impound runoff. Other impoundments in the region and corresponding issues related to their storage capacity and flood hydrology are discussed in previous NEPA assessments (BLM 2008b).

3.13.1.3 Surface Water Quality

Water quality standards and related considerations are closely tied to the uses of the water. Beneficial uses of surface water are designated by the State of Utah (Utah Administrative Code 2007). None of the streams or waterbodies in the GNBPA are classified by the state as High Quality Waters (Utah Division of Water Quality 2007). Beneficial uses for major streams in the study area are indicated in **Table 3.13-5**.

Table 3.13-5 Beneficial Use Designations for Surface Waters

Waterbody Segment	Designated Beneficial Uses[1]
Willow Creek and tributaries, to headwaters	2B, 3A, 4
White River and tributaries (except as listed below)	2B, 3B, 4
Bitter Creek and tributaries, to headwaters	2B, 3A, 4

[1] Protected Beneficial Use Classifications: 2B – Secondary contact recreation such as boating, wading or similar uses; 3A – Cold water game fish and aquatic life; 3B – Warm water game fish and aquatic life; 4 – Agricultural uses.

Surface water quality in the study area reflects geologic sources, runoff conditions (e.g., land use patterns, snowmelt, or thunderstorms), and water uses such as inflows returning from irrigated croplands. Most of the water in the White River originates from mountainous uplands to the east and south of the study area. The lower basin, which comprises the semi-arid lowlands of the study area, contributes little of the overall annual volume in the White River. However, after the spring runoff has passed, contributions from the study area make up a larger portion of the river flow. Water quality generally deteriorates during the low flow seasons due to conditions in the lower basin, and because there is less water to dilute the salts and sediments carried in the flow. However, no beneficial uses are impaired by water quality conditions in the Lower White River Basin. In the study area, only Willow Creek is impaired by total dissolved solids.

Estimated sediment yields in the study area are indicated in **Figure 3.13-2**. In upland areas, estimated sediment yields generally range between 0.5 to 1.0 acre-feet per square mile of contributing watershed per year. In the areas bordering the major rivers and Willow Creek, smaller sediment yield rates of approximately 0.1 to 0.2 acre-feet per square mile per year are estimated to occur.

In the Colorado River drainage overall, which includes the White River Basin, the salinity of water has been a major concern for decades. The high concentrations of salts in surface and groundwater in the region originate from geologic sources, which include sedimentary rocks deposited in both marine and freshwater environments. As water is used for irrigation, salts from croplands are carried in the flows that return to rivers and streams. This occurs repeatedly as water is withdrawn, re-used, and returned on its way downstream. As a result, salinity increases and total dissolved solids accumulate in surface waters.

A number of state and federal agencies have been involved in managing salinity in the Colorado River watershed since the Colorado River Salinity Control Act was passed in 1974. An amendment in 1984 directed the BLM to implement programs that minimize salt loading from lands it administers in the Colorado River Basin. These lands include those in the Green River Basin, and the study area in tributary watersheds such as the White River.

During the period 1975 to 1983, the White River in Utah accumulated approximately 40,000 tons of dissolved solids per year, almost all from Bitter Creek and other small streams between the state line and the river mouth (Liebermann et al. 1989). During that period, the mean annual flow-weighted dissolved solids concentration in the White River was 419 milligrams per liter. This value is substantially reduced from the average concentrations in earlier years (before 1969), largely due to plugging of an abandoned well in the upgradient watershed towards Meeker, Colorado (Liebermann et al. 1989). Plugging of additional exploration wells near Meeker, Colorado, in the early 1980s also substantially improved water quality in the White River (Liebermann et al. 1989).

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T5S R3E
T8S R20E
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T10S R23E
T10S R24E
T11S R20E
T11S R21E
T11S R22E
T11S R23E
T11S R24E
Green River
White River
Bitter Creek
White River
Hill Creek
Willow Creek

LEGEND

- Township/Range
- EIS ProjectArea
- Named Streams and Rivers

Estimated Sediment Yield

Estimated Yield

- 0.1 - 0.2 AC FT/SQ MI/YR
- 0.5 - 1.0 AC FT/SQ MI/YR

N

1 0.5 0 1 2
Scale in Miles
2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.13-2

Estimated Sediment Yields

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It should be noted that for historical low-flows, the trend in dissolved solids concentrations for the White River was essentially linear having a gradual, steady rise downstream of a point about 5 miles west of Rangely, Colorado (Boyle et al. 1984). Streamflow temperature gradually rose downstream from about the same point. Dissolved oxygen (as a percentage of saturation) and pH gradually decreased in linear trend, whereas dissolved nitrogen rapidly increased (Boyle et al. 1984). Based on these data and the historical effects of well abandonment, some water quality conditions in the river may result from widespread, more regional causes. Previous water quality investigators also examined dissolved solids on a monthly and annual basis (Boyle et al. 1984, Liebermann et al. 1989). The mean annual flow-weighted dissolved solids concentration in Bitter Creek from 1975 to 1983 was 6,740 milligrams per liter, the highest value in the regional study by Liebermann et al. (1989).

Much of the dissolved material is of geologic origin, carried in runoff from the Uinta Formation. This bedrock is widespread within the cumulative study area. It contains gypsum and a thick, saline layer deposited on an ancestral lake bed. Based on scattered data and a regression analysis, Bitter Creek discharged about 10,200 tons of dissolved solids per year to the White River in the late 1970s and early 1980s (Boyle et al. 1984). At the same time, Coyote Wash is estimated to have discharged about 19,000 tons. Willow Creek also has been noted for elevated total dissolved solids concentrations (Utah Division of Water Quality 2007).

Further data collection and semi-quantitative interpretations were conducted as part of this EIS, using water quality data from the USEPA STORET database (USEPA 2009b). Sampling results for two monitoring stations were investigated: the White River near Bonanza at the Utah Highway 45 crossing, and the White River near Ouray at the Utah Highway 88 crossing. The first station is upstream of the GNBPA, and the second station is downstream of most of the GNBPA (**Figure 3.13-1**). Data were retrieved for the period 1976 through 2006. This period post-dates most of the information that was reviewed from USGS sources and covers the increasing oil and gas development in the GNBPA. Data representing 197 samples were retrieved for Ouray. Due to missing data at Bonanza, 139 sampling data were retrieved. As available, the Bonanza sampling dates matched the dates of sampling at Ouray to form data pairs.

Instantaneous water quality and flow data were collected by UDEQ and retrieved from the STORET database. Supplementary daily and monthly mean flow data were retrieved from USGS gages at or near the UDEQ sampling sites (NWIS 2009). Mean monthly flow data also were collected for the USGS gages upstream on the White River at Rangely and Meeker, Colorado. Monthly mean precipitation data were retrieved from the climate stations at Bonanza and Ouray (Western Regional Climate Center 2007b). Subsequent efforts focused on searching for trends in concentrations, through time, of total suspended solids (TSS) (as a measure of sediment load) and total dissolved solids (TDS) (as a measure of salinity) for different streamflows and seasons.

Interpretations of historical data from the lower White River Basin are obscured by the natural conditions of aridity, erosion, and saline/alkaline sedimentary geology, as mentioned above. In addition, instantaneous (grab) samples represent a single point in time, but sediment and dissolved solids concentrations can vary dramatically within a day. Influences from livestock, short-term roadwork, erosion episodes, or other factors may all create dramatic changes in water quality through time at a single location, or from one location to another. Assessments are further complicated by inflow characteristics from upstream, groundwater contributions, and by variable travel times for flow between sampling stations. Because of these considerations, conclusions based on the existing data are of a general, semi-quantitative nature.

When comparing available water quality data to well-count records from UDOGM, development in the basin area can be grouped into the periods 1976 through 1984, 1985 through 1994, and 1995 through 2006. An initial review grouped data into these general periods by season. Based on this approach, for any flow rate there was overall evidence of an increase over time in TSS concentrations downstream at Ouray when compared to Bonanza (Watson gage) upstream of the GNBPA. There were no trends for TDS concentrations over time between the stations.

A subsequent approach used selected data for March or April, and for August, September, or October, for average or higher precipitation at Ouray and/or Bonanza, accompanied by average or lower flows at Rangely and/or Meeker in those months. This approach was oriented to periods when rainfall and unfrozen conditions in the basin were most likely to cause runoff from the GNBPA without substantial contributions to the river from upstream. After this screening (and removal of strongly suspect data), 21 data pairs remained for TDS and 14 data pairs remained for TSS. Under this approach, there was a subtle but discernible decline in TDS concentrations at both Bonanza (Watson) and Ouray over time. Between 1980 and 2006, concentrations of TDS ranged from 368 to 786 milligrams per liter (mg/L) at Bonanza (Watson) and from 352 to 828 mg/L at Ouray. The data values downstream at Ouray typically exceeded those at Bonanza by approximately 60 mg/L. TSS concentrations, with rare exceptions, were greater at Ouray than at Bonanza upstream, and frequently much greater. However, more specific trends over time were not readily discernible. For the selected data set, concentrations of TSS ranged from 70 to 1,786 mg/L at Ouray, and from 17 to 816 mg/L upstream at Bonanza. The data values downstream at Ouray typically exceeded those at Bonanza by approximately 300 mg/L. Based on this review of available data, there is no indication that more extensive oil and gas development has increased suspended sediment concentrations in the lower White River.

3.13.2 Floodplains, Waters of the U.S., and Wetlands

3.13.2.1 Definitions of terms

Floodplains

From a geomorphic perspective, floodplains are relatively low, flat areas of land that surround water bodies and hold overflows during flood events. Floodplains are often associated with rivers and streams, where they consist of sediments forming levels (or “terraces”) deposited at different times along the watercourse.

From a policy perspective, the Federal Emergency Management Agency (FEMA) defines a floodplain as being any land area susceptible to being inundated by waters from any source (FEMA 2005, 2001). Protection of floodplains and related resource values was established by EO 11988. Local, state, and federal agencies have additional roles and responsibilities under EO 11988 and the FEMA floodplain program, particularly with respect to potential impacts on flooding from proposed projects. In addition, regulatory programs provide rigorous guidance on the types, extent, and location of project facilities that may be constructed within delineated floodplain boundaries.

Waters of the U.S.

These resources are defined in 33 CFR Part 328, Section 3. They include all non-tidal waters that are currently, or were used in the past, or may be susceptible to use in interstate commerce; all interstate waters including wetlands; all other waters such as interstate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate commerce; and all impoundments of waters otherwise defined as Waters of the U.S. under this definition. In addition, tributaries of the above listed waters, including arroyos and other intermittent drainages, and wetlands adjacent to the above waters also are considered to be Waters of the U.S.

Criteria used by the USACE to determine whether a drainage constitutes a Waters of the U.S. include presence of a defined bed (a linear bed in a topographic depression which would transport surface water from a watershed); presence of defined banks (near vertical or steep-sided banks formed by erosion from flowing water); and evidence of an ordinary high water mark (indicator[s] that the drainage is subject to surface water flows on an average annual basis; such indicators include a scoured bed, shelving, an absence of terrestrial vegetation and recent alluvial or litter deposition).

Wetlands

As described above, wetlands adjacent to other Waters of the U.S., such as streams, also are considered to be Waters of the U.S. In addition, and as used herein, the term “wetlands” has a regulatory definition as

defined in 33 CFR 328, 7(b). The term “wetland” is defines as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.” Note that the frequency and duration of saturation may vary by geographical region, and is largely dependent upon local climatic conditions.

According to the USACE’s 1987 Wetland Delineation Manual, a "three-parameter" approach is required for delineating USACE-defined wetlands (USACE 1987). Based on this approach, areas are identified as wetlands if they exhibit the following characteristics:

1. The prevalence of vegetation consisting of hydrophytic species or plants that have the ability to grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content and depleted soil oxygen levels.
2. The presence of soils that are classified as hydric or possessing characteristics that are associated with reducing soil conditions. Hydric soils are poorly drained and have a seasonal high water table within 6 inches of the surface.
3. An area that is inundated either permanently or periodically at mean water depths less than or equal to 6.6 feet or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation (usually 12.5 percent of the growing season). Within the study area, an area would need to be saturated for a period of approximately 18.9 days to support vegetation adapted to saturated soils since the average number of days above 32°F in the area is approximately 151 (151 x 0.125) (NRCS 2006).

The USACE (1987) requires that, under normal circumstances, all three of these conditions be met for an area to be considered a wetland under the USACE’s definition.

Isolated Wetlands or Waters of the United States

Isolated waters are generally described as not having contiguity or ecological relationships to other Waters of the U.S. Under certain situations, these may include vernal pools, prairie potholes, playa basins, and associated wetlands and tributaries. There are no known occurrences of isolated wetlands in the GNBPA.

3.13.2.2 Regulatory Coordination

Numerous stream channels located within the study area may be considered Waters of the U.S. based on their connectivity to the White and Green rivers. Of these, approximately six tributaries are intermittent or perennial (Lindskov and Kimball 1984a). Disturbance of Waters of the U.S. would be regulated by the USACE under CWA Section 404, and a USACE permit would be required and obtained prior to construction. A wetlands and Waters of the U.S. assessment would be conducted concurrently with the BLM, the Ute Tribe, and State of Utah on-site inspections. If necessary, consultation with the Sacramento District of the USACE would be conducted, a subsequent jurisdictional determination would be obtained, and permit requirements would be determined at that time.

3.13.2.3 Existing Resources

Floodplains

Within the study area, zones likely to be inundated from a 100-year, 24-hour event are indicated on **Figure 3.13-3**. Outside the Uintah and Ouray Reservation, these areas were delineated by FEMA (1977) and developed into a GIS shapefile. Within the reservation boundaries, hydraulic analysis by Rhino Engineering, LLC (Rhino Engineering, LLC 1999) in addition to topographic maps and aerial photographs were used to digitize the geomorphic floodplain during the preparation of this EIS as a means of estimating floodplain boundaries. Based on these sources, approximately 10,840 acres within the GNBPA also occur within the 100-year, 24-hour flood hazard zone.

Waters of the U.S.

Waters of the U.S. within the GNBPA include the White River and its tributaries such as Bitter Creek, Sand Wash, Cottonwood Wash, Coyote Wash, and their tributaries.

Public Water Reserves

One type of federal reserved water right associated with BLM lands is for public water holes and springs. These rights were created by executive orders called Public Water Reserves (PWRs), and until 1926, these were created on an ad hoc and site-specific basis. Federal agencies would identify the springs they wanted reserved, and these would be incorporated (by executive order) into a chronologically numbered PWR. Therefore, PWRs with early numbers refer to site-specific reservations. In 1926, a more generic PWR was created through an executive order entitled Public Water Reserves No. 107. PWR 107 ended the site-specific system of reserving springs and water holes. The purpose of PWR 107 was to reserve natural springs and water holes yielding amounts in excess of homesteading requirements. Under this order, all land within 0.25 mile of public lands that are vacant, unappropriated, or unreserved, and contain a spring or water hole, are reserved for public use. There was no intent to reserve the entire yield of each public spring or water hole; rather, reserved water was limited to domestic human consumption and stockwatering. All waters from these sources, in excess of the minimum amount necessary for these limited public watering purposes, are available for appropriation through state water law. To date, many of these PWRs have not been registered with the state and/or are not adjudicated.

As illustrated on **Figure 3.13-3**, there are four PWRs located within the GNBPA. These public water holes and springs would be identified and avoided through the onsite review process and APD surface use plan review.

Wetlands

The GNBPA is located within the Uinta Basin, a region characterized by a semi-arid or arid climate, and xeric rolling topography with widespread ephemeral or intermittent streams. Wetland areas, as previously defined, are present along and adjacent to perennial and intermittent drainages within the study area (Lindskov and Kimball 1984a). Wetlands were identified in the study area using data downloaded from TerraServer and wetland and riparian area mapping conducted by the BLM. Perennial and intermittent drainages within the study area include the Green River, White River, Bitter Creek, Coyote Wash below Red Wash, lower Sand Wash, and Cottonwood Wash. In the GNBPA, wetlands and riparian areas have been mapped by the BLM on lands that the agency administers (**Figure 3.13-4**). For the rest of the study area, USFWS National Wetland Inventory is not available. For these areas, SWReGAP data was used to identify riparian habitat along perennial and intermittent streams within the GNBPA on non-BLM lands. SWReGAP riparian types along these drainages include riparian woodlands and shrublands, and wet meadows.

There are 4,961 acres of riparian types in the GNBPA, comprising approximately 3 percent of the area (**Table 3.11-1**). Of these areas, almost all (4,837 acres) occur within the delineated 100-year floodplains. Wetlands present in these riparian areas generally would consist of palustrine emergent, palustrine scrub shrub, palustrine forested, palustrine unconsolidated, and riverine systems as classified using the Classification of Wetlands and Deepwater Habitats of the U.S. (Cowardin et al. 1979). Common wetland species would be the same as described for the riparian vegetation cover type (Section 3.11, Vegetation).

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Green River
White River
Red Wash
Kennedy Wash
Coyote Wash
Cottonwood Wash
Willow Creek
Hill Creek
Sand Wash
Bitter Creek
Asphalt Wash

Utah
Uintah County
Area of Detail

Legend

- EIS ProjectArea
- Township/Range
- Named Streams and Rivers
- Public Water Reserves
- Hundred Year Floodplains (FEMA and Rhino Engineering Delineations)
- Floodplains (Topographic Map and Aerial Photo Interpretations)

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Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.13-3

Hundred-year Floodplains and Public Water Reserves

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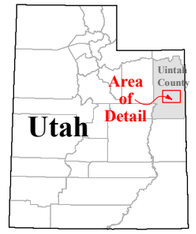

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- EIS ProjectArea
- Township/Range
- Riparian Areas (BLM)
- Riparian Areas (SWReGAP)

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Scale in Miles

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Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.13-4

Riparian Areas

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3.13.3 Groundwater Resources

Three major aquifer systems are present in the GNBPA and surrounding region. As shown in **Figure 3.13-5**, these regional systems can be grouped as follows:

- Uinta-Animas aquifer (includes shallow alluvial aquifers, and the consolidated Bird's Nest and Douglas Creek aquifers);
- Mesaverde Aquifer; and
- Dakota-Glen Canyon aquifer system (includes The Dakota, Morrison, Entrada, and Glen Canyon aquifers).

3.13.3.1 Shallow Aquifers

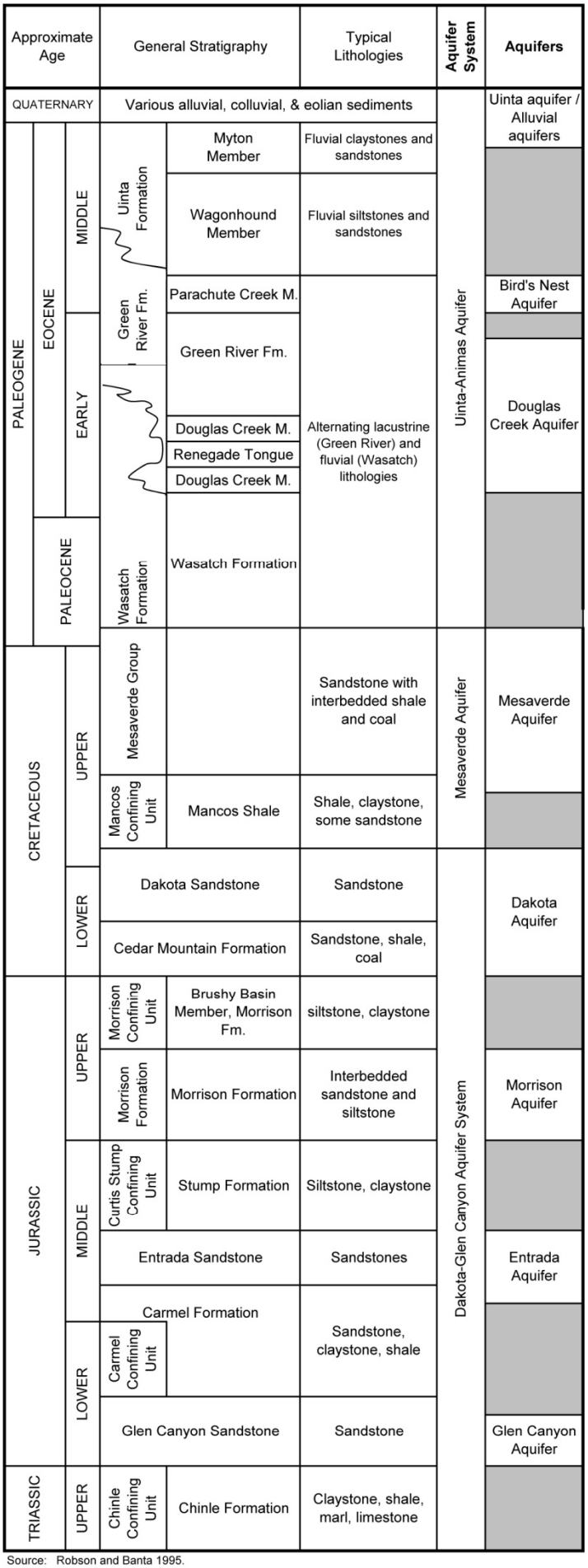
The shallow water-producing units in the GNBPA primarily consist of alluvial deposits. In these water-bearing zones, the depth to water generally ranges from about 5 feet along the White River to approximately 20 feet along Bitter Creek (Holmes and Kimball 1987). Depths to water may be shallower or deeper depending on location, seasonal precipitation or snowmelt, and local geologic conditions. For example, groundwater surfaces as perennial springs along Bitter Creek approximately 2 miles upstream from its mouth.

Alluvial aquifers are of small areal extent, occurring along major drainages. They are primarily composed of silts and clays that were eroded from exposed surfaces of the Uinta Formation and deposited as unconsolidated valley fills. Sandy and gravelly Quaternary stream sediments also make up smaller portions of alluvial aquifer zones (Holmes and Kimball 1987). These alluvial deposits and aquifers primarily occur along the larger streams in or near the GNBPA, such as the Green River, White River, Bitter Creek, and Willow Creek. Smaller areas of alluvial aquifers also occur along lesser streams such as Cottonwood Creek and Coyote Wash. The average thickness of alluvial fill in the Bitter Creek and Willow Creek drainages is on the order of 100 feet, whereas the average thickness along the White River is about 30 feet (Holmes and Kimball 1987).

Water in the alluvial aquifers is discharged by springs, evapotranspiration, and wells, and by subsurface flow or leakage into deeper consolidated aquifers. Based on groundwater modeling, discharge from alluvial aquifers to consolidated-rock aquifers in the southeastern Uinta Basin overall is estimated to be approximately 2,000 acre-feet per year. This represents the amount of recharge from alluvial aquifers required to balance the steady-state discharge of the consolidated-rock aquifers in the region (Holmes and Kimball 1987). However, this estimate represents a more regional perspective, since much of the leakage and recharge between the alluvial aquifers and deeper consolidated bedrock aquifers occurs at higher elevations well outside the GNBPA (Holmes and Kimball 1987).

Generally, the rate of water movement in the alluvial aquifers is slow due to the minimal permeability of the fine-grained alluvial deposits. Water-level gradients in major drainages average about 40 feet per mile and the average velocity of water moving through alluvial aquifers is about 0.4 feet per day (Waltemeyer 1982). The volume of water stored in alluvial aquifers in the southeastern Uinta Basin is estimated to be 675,000 acre-feet. However, the volume of recoverable water locally is a function of the specific yield, and the estimated total amount of water that is theoretically recoverable from storage is only 200,000 acre-feet. Maximum yields to individual wells are less than 1,000 gallons per minute (Wanty et al. 1991).

Chemical quality of the shallow groundwater in the southeastern Uinta Basin varies considerably. Water from alluvial wells ranges from about 440 to 27,800 mg/L of dissolved solids. Groundwater from the alluvial aquifers is very alkaline, and the alluvial aquifers contain very hard water. During periods of low flow in the White River, the primary recharge source, the dissolved-solids concentration is almost 1,000 mg/L, and is slightly saline (Lindskov and Kimball 1984b). In general, alluvial aquifer groundwater is not suitable for public supply, but may have value for other uses, such as irrigation, stock water, and limited domestic supply.



Source: Robson and Banta 1995.

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.13-5

General Stratigraphy And Water Bearing Units

3.13.3.2 Deeper Aquifers

Of the major regional aquifer units identified earlier, the remaining deeper aquifer zones are comprised of consolidated bedrock formations of varying age. The Uinta Formation, of Tertiary age, is exposed at the surface of the GNBPA and surrounding region (Price and Miller 1975). It mostly consists of thinly-bedded shale, siltstone, and fine-grained sandstone with interbedded claystone and limestone. The Uinta Formation is generally not water-bearing in most locations, due to drainage by deeply-incised streams (Price and Miller 1975). In some parts of the southern Uinta Basin, the Uinta Formation may be saturated in discontinuous perched aquifers. These zones typically yield less than 5 gallons per minute (Price and Miller 1975). Such zones are most likely to occur at higher elevations outside the GNBPA, where recharge and discharge rates are greater. Given these factors, the Uinta Formation is not likely to be an important water-bearing zone in the GNBPA.

The Bird's Nest and Douglas Creek aquifers consist of portions of the Green River Formation of Tertiary age (**Figure 3.13-5**). The Bird's Nest aquifer is a part of the Parachute Member of the Green River Formation, and likely extends from Evacuation Creek (east of the GNBPA) west to Bitter Creek and several miles to the north of the White River (Holmes and Kimball 1987). Based on **Figure 3.13-1**, it is estimated to underlie approximately one-quarter of the GNBPA. The Parachute Creek Member consists of lacustrine deposits of thinly-bedded claystone and siltstone (both referred to as marlstone), as well as fine-grained sandstone, limestone, and some volcanic tuff (Holmes and Kimball 1987). The Bird's Nest zone contains cavities created by the removal of readily-soluble minerals.

According to Holmes and Kimball (1987), depths to water in the Bird's Nest aquifer range from several feet near Evacuation Creek east of the GNBPA, to 400 feet or more in the west. Water levels recorded near the White River a few miles east of Asphalt Wash indicate depths of between 150 to 155 feet (Holmes and Kimball 1987). The aquifer discharges to the White River and to Bitter Creek as a result of geologic structures and upward leakage through overlying rocks. Recharge occurs from the infiltration of streamflow in the vicinity of Evacuation Creek, and elsewhere from downward leakage through the Uinta Formation.

The Birds Nest aquifer currently is being used by KMG within the central portions of the GNBPA for disposal of produced water from existing oil and gas operations. Since 1994, KMG has injected approximately 16,000,000 bbls of produced water into the aquifer. In the central portions of the GNBPA, the Birds Nest aquifer is found at a depth of 1,700 feet below ground surface and ranges in thickness from 220 to 420 feet. It has high porosity and permeability due to the dissolution of nahcolite (sodium bicarbonate) nodules. Groundwater flow in the Birds Nest aquifer in the GNBPA is from southeast to northwest.

Water quality within the Birds Nest aquifer declines as groundwater moves to the northwest from recharge areas located to the south and southeast of the GNBPA. In the northern portion of GNBPA, water samples from the Birds Nest aquifer have TDS values that range from 18,600 to 66,300 mg/L. By comparison, the produced water in the GNBPA ranges from 25,000 to 30,000 mg/L. The poorer water quality is a natural characteristic of groundwater whereby water quality becomes progressively and naturally degraded as the water flows deeper into the basin. In the Birds Nest aquifer, the degradation is thought to be enhanced by the dissolution of nahcolite and other soluble minerals in the rock. Toward the south, or up-dip in the direction of the recharge area, the water in the aquifer becomes fresher and TDS values are less than 10,000 mg/L.

The Douglas Creek aquifer consists of sandstone and limestone. The overall waterbearing zone consists of the Douglas Creek Member of the Green River Formation, and the Renegade Tongue of the Wasatch Formation. Stratigraphically, the two zones interfinger. Based on existing literature (Holmes and Kimball 1987), the aquifer may outcrop in deeply incised canyons several miles south of the GNBPA. Recharge of the aquifer generally occurs at the higher elevations several miles south of the GNBPA, most notably from precipitation and along incised canyons with porous alluvial deposits (Holmes and Kimball 1987). Recharge is limited northward across most of the GNBPA, where the Douglas Creek aquifer is isolated under relatively impermeable marlstones, siltstones, and oil shale within the Parachute Creek Member. Discharge from the

aquifer occurs in the canyons generally south of the GNBPA, and by seepage to the White and Green Rivers (Holmes and Kimball 1987).

The Mesaverde Aquifer and the Dakota – Glen Canyon aquifer system generally consist of much deeper sandstones interbedded with shales and siltstones. They provide little or no discharge to streams, and no withdrawals are made from them for beneficial uses in the GNBPA or surrounding region. Oil and gas drilling may produce water from these zones.

Widespread deep groundwater development in the southern Uinta Basin for domestic, livestock, or industrial uses has been limited because of poor water quality (BLM 2008b). TDS values from less than 500 mg/L have been recorded from wells screened in alluvial deposits to over 4,000 mg/L for wells screened in the Green River Formation and can exceed 10,000 mg/L locally in the Uinta Formation (BLM 2007d). Deeper aquifers regularly have TDS values exceeding 25,000 mg/L (Cashion 1967).

3.13.3.3 Groundwater Protection

An aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer is defined by USEPA as a sole or principal source aquifer. In order to protect these sources of drinking water, particularly in areas where no alternative drinking water source is available, the USEPA formally designates these aquifers as a SSA. The GNBPA does not overlie nor is in close proximity to a designated SSA.

DWSPZs are designated under the State of Utah's Drinking Water Source Protection program to protect wells and springs from contamination. Nineteen water wells located in Bonanza, Utah, withdraw ground water from shallow alluvium. While the wells are not located within the GNBPA, the 2-mile diameter DWSPZ associated with them overlaps the far eastern portion of the GNBPA (**Figure 3.13-6**).

On federal leases, usable ground water resources are protected during drilling in accordance with BLM Onshore Oil and Gas Order No. 2, which requires that all formations containing usable quality water (≤10,000 mg/L total dissolved solids) be isolated and protected utilizing cement. For an existing lease overlying a SSA or a DWSPZ, a COA would be attached to an approved APD requiring the lessee/operator to contact the public water system manager to determine any zoning ordinances, best management or pollution prevention measures or physical controls that may be required within the protection zone.

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Green River
White River
Willow Creek
Hill Creek
Willow Creek
Bitter Creek
White River

Legend

- EIS ProjectArea
- Township/Range
- Named Streams and Rivers

Ground Water Source Protection Zone

- GW1 (100-Foot Radius)
- GW2 (250-Day Travel Time)
- GW3 (3-Year Travel Time)
- GW4 (15-Year Travel Time)

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Greater Natural Buttes Area Gas Development Project EIS

Figure 3.13-6
Groundwater Source Protection Zones

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3.14 Wilderness Characteristics

Wilderness study areas (WSAs) were established in the 1980s as part of the public process of determining which lands have wilderness characteristics and should be considered by Congress for wilderness designation. Since then, the BLM has inventoried public lands statewide that are located outside of existing WSAs and found approximately 2.6 million acres have wilderness characteristics. These lands, known as non-WSA lands with wilderness characteristics, are areas that generally have at least 5,000 acres in a natural or undisturbed condition and provide outstanding opportunities for solitude or primitive forms of recreation. Information on these lands is documented in an April 2007 Wilderness Characteristics Review in the BLM Vernal Field Office management area and is summarized in the BLM Vernal Proposed RMP and Final EIS (BLM 2008c).

As shown in **Figure 3.14-1**, three areas of non-WSA lands with wilderness characteristics are located near or overlap with the GNBPA. The area identified as "White River" is the only area that overlaps with the GNBPA, and a portion of this is being managed as a BLM natural area (BLM 2008b). The BLM White River natural area and the White River non-WSA lands with wilderness characteristics are discussed in more detail in the subsections below.

3.14.1 BLM White River Natural Area

A 6,716-acre area near the southeastern portion of the GNBPA has been identified as having wilderness characteristics and is referred to as the BLM White River natural area (**Figure 3.14-1**). Approximately 737 acres of this natural area is located within the GNBPA. According to the Vernal RMP (BLM 2008b), BLM natural areas are managed to protect, preserve, and maintain values of primitive recreation, the appearance of naturalness, and solitude. While available for oil and gas leasing, the BLM White River natural area is managed with a no surface occupancy (NSO) stipulation (BLM 2008b). There currently are no existing leases within the portion of the natural area that overlap with the GNBPA.

3.14.2 Non-WSA Lands with Wilderness Characteristics

A 21,210-acre area adjacent to the White River near the southeastern portion of the GNBPA was inventoried by BLM and found to have wilderness characteristics (**Figure 3.14-1**). Approximately 2,786 acres of this area lie within the GNBPA and outside of the BLM White River natural area.

During the Vernal Field Office planning process, a BLM interdisciplinary team inventoried 34 areas within the Vernal Field Office management area to determine if these areas possess wilderness characteristics. The team determined that 25 of the 34 areas outside of existing WSAs, totaling approximately 277,596 acres, were found to have wilderness characteristics. They also determined that 133,723 acres did not possess wilderness characteristics. The lands found to have wilderness characteristics were carried through the land use planning process to assess the impacts of management options on these lands and to determine how wilderness characteristics would be managed. Fourteen areas, totaling 106,198 acres, were carried forward in the Final RMP as BLM natural areas that are to be managed to protect, preserve, and maintain their wilderness characteristics values. The other lands, including portions of the White River non-WSA lands with wilderness characteristics, are subject to other management decisions that allow for degradation or loss of the wilderness characteristics and values.

As disclosed under the decision record for the Bonanza EA (2006b), seven well pads have been constructed, and wells have been drilled within the White River non-WSA lands with wilderness characteristics. This has been the only oil and gas related surface disturbing activity to date within the White River non-WSA lands with wilderness characteristics that overlaps the GNBPA.

The BLM Vernal RMP (BLM 2008b) did not carry portions of the White River area forward as a BLM natural area for the protection, preservation, or maintenance of wilderness characteristics. The analysis in the Proposed RMP and Final EIS (BLM 2008c) clearly portrayed that 45 percent of this area was leased and

would have a direct loss of natural characteristics as well as a reduction in the quality of opportunities for solitude and primitive and unconfined recreation due to the sights and sounds associated with development. The analysis ultimately determined that 54 percent of the White River non-WSA area with wilderness characteristics would be affected by oil and gas development over the life of the plan. A full analysis of impacts to areas with wilderness characteristics in the Vernal Field Office management area is contained in the Proposed RMP and Final EIS.

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T12S R25E
Duchesne River
Green River
White River
Bitter Creek
Hill Creek
Willow Creek
Evacuation Creek
Desolation Canyon
White River
Lower Bitter Creek

Utah
Area of Detail
Uintah County

LEGEND

- Township/Range
- EIS Project Area
- Named Streams and Rivers
- Non-WSA Lands with Wilderness Characteristics
- BLM White River Natural Area
- White River SRMA
- Fantasy Canyon SRMA

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Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.14-1

Non-WSA Lands with Wilderness Characteristics, BLM Natural Areas and SRMAs

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3.15 Wildlife and Fisheries Resources

The study area for wildlife and fisheries resources is the GNBPA. As discussed in Section 3.11, Vegetation Resources, nine vegetation cover types and two land use cover types are located within the GNBPA. The vegetation cover types include salt-desert shrubland, sagebrush shrubland, pinyon-juniper woodland, grassland, cliff/canyon, agriculture, riparian habitats, developed lands (i.e., industrial/commercial), and barren lands. Salt-desert shrubland is the most common vegetation community within the GNBPA. A variety of terrestrial wildlife species are associated with upland communities, with greater species diversity occurring in areas exhibiting greater vegetative structure and soil moisture, such as pinyon-juniper woodlands and riparian communities found along the Green River, White River, and Bitter Creek.

Information regarding wildlife species and habitat within the GNBPA and cumulative effects study area (defined as the Vernal Field Office boundary) was obtained from a review of existing published sources, BLM, UDWR, and USFWS file information, as well as UNHP database information.

3.15.1 Wildlife

Wildlife species and habitats occurring within the GNBPA are typical of the intermontane zone of the East Tavaputs Plateau. This area has highly varied topography of sand/gravel washes, dry upland benches, rocky cliffs, and outcroppings. Wildlife habitat within the GNBPA consists primarily of salt-desert shrub and sagebrush communities with interspersed grasslands. Pinyon-juniper woodlands occur on higher elevation sites, mainly in the southwestern portion of the GNBPA. Riparian areas are limited to the Green River, White River, and Bitter Creek drainages.

Available water for wildlife consumption is limited in the project region. Water sources in the vicinity of the project, particularly those that maintain open water and a multi-story canopy, support a greater diversity and population density of wildlife species than any other habitat types occurring in the region. Man-made water sources (guzzlers) are found on BLM- and state-managed lands throughout the region and are important sources of water for wildlife species in upland areas with little or no surface water sources. Wildlife utilizing guzzlers include a wide array of species from birds and bats to big game.

3.15.1.1 Game Species

Big Game

According to UDWR (2007a), the GNBPA is located within Wildlife Management Units (WMU) 9 (north of the White River) and 10 (south of the White River). However, the vast majority of the GNBPA is located within WMU 10. Big game habitat information (e.g., year-long crucial habitat, winter habitat) and GIS shapefiles were obtained from the UDWR website. This information is updated regularly and presents the most accurate data for the GNBPA. Big game species that may occur in the GNBPA include pronghorn, mule deer, elk, Rocky Mountain bighorn sheep, and bison (BLM 2008c; UDWR 2007a). The UDWR (2007a) designates big game habitat as either crucial or substantial. Crucial value habitat is essentially the habitat needed to maintain the core population of a species within a certain region/area. Degradation or unavailability of crucial habitat would lead to significant declines in carrying capacity and/or numbers of wildlife species in question. Habitat designated as substantial is defined as habitat that is used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat would not lead to significant declines in carrying capacity and/or numbers of the wildlife species in question.

Pronghorn are most prominent in portions of the GNBPA with adequate forage and surface water (BLM 2008c; UDWR 2007a). Pronghorn habitat is characterized by rolling, wide-open, expansive areas within grassland and sagebrush vegetation zones. In 2006, UDWR trend data indicated a total of 585 animals in WMU 9 and 642 animals in WMU 10 (UDWR 2007a). Population levels increased in both WMUs in 2007 to a total of 794 animals in WMU 9 and 927 animals in WMU 10 (UDWR 2008b). Populations in both WMUs decreased slightly in 2008, back to 2006 levels. Since 2005, annual harvest estimates indicate approximately 40 animals per year have been harvested in WMU 9 and 20 to 40 animals per year have been harvested in WMU 10.

Overall, populations of pronghorn within the GNBPA have decreased since the late 1990s due to habitat loss and drought (UDWR 2008b). Nearly the entire GNBPA is classified as year-long crucial habitat for pronghorn. Designated pronghorn habitat is presented in **Figure 3.15-1.**

Mule deer are widespread throughout the GNBPA. In 2006, the UDWR estimated a total population of approximately 21,300 animals with a fawn/doe ratio of 60/100 in WMU 9 and 7,200 animals with a fawn/doe ratio of 61/100 in WMU 10 (UDWR 2007a). Mule deer year-long crucial habitat is found in the northern portion of the GNBPA, primarily in the drainages and uplands adjacent to the White River. Mule deer winter habitat is found in the southern portion of the GNBPA. Designated mule deer habitat is presented in **Figure 3.15-2.**

Elk also occur infrequently in the pinyon-juniper habitat found within the GNBPA, particularly in the fall and winter months. In 2006, the UDWR estimated 8,630 elk in WMU 9 and 3,900 elk within WMU 10 with a calf/cow ratio of 45/100 and 39/100 respectively (UDWR 2007a). Several small areas in the extreme southern portion of the GNBPA are classified as elk winter habitat. Designated elk habitat is presented in **Figure 3.15-3.**

Rocky Mountain bighorn sheep are found in several small herds in northeastern Utah (BLM 2008c). The State of Utah has been involved in an aggressive reintroduction program for the past 30 years. Today, bighorn sheep are found in two areas: along the Upper Green River and in the Book Cliffs area (BLM 2008c). The UDWR has established habitat designations along the White River and Bitter Creek in anticipation of future reintroduction efforts. Rocky Mountain bighorn sheep year-long crucial habitat is found mainly in the southeast portion of the GNBPA. Designated Rocky Mountain bighorn sheep habitat is presented in **Figure 3.15-4.**

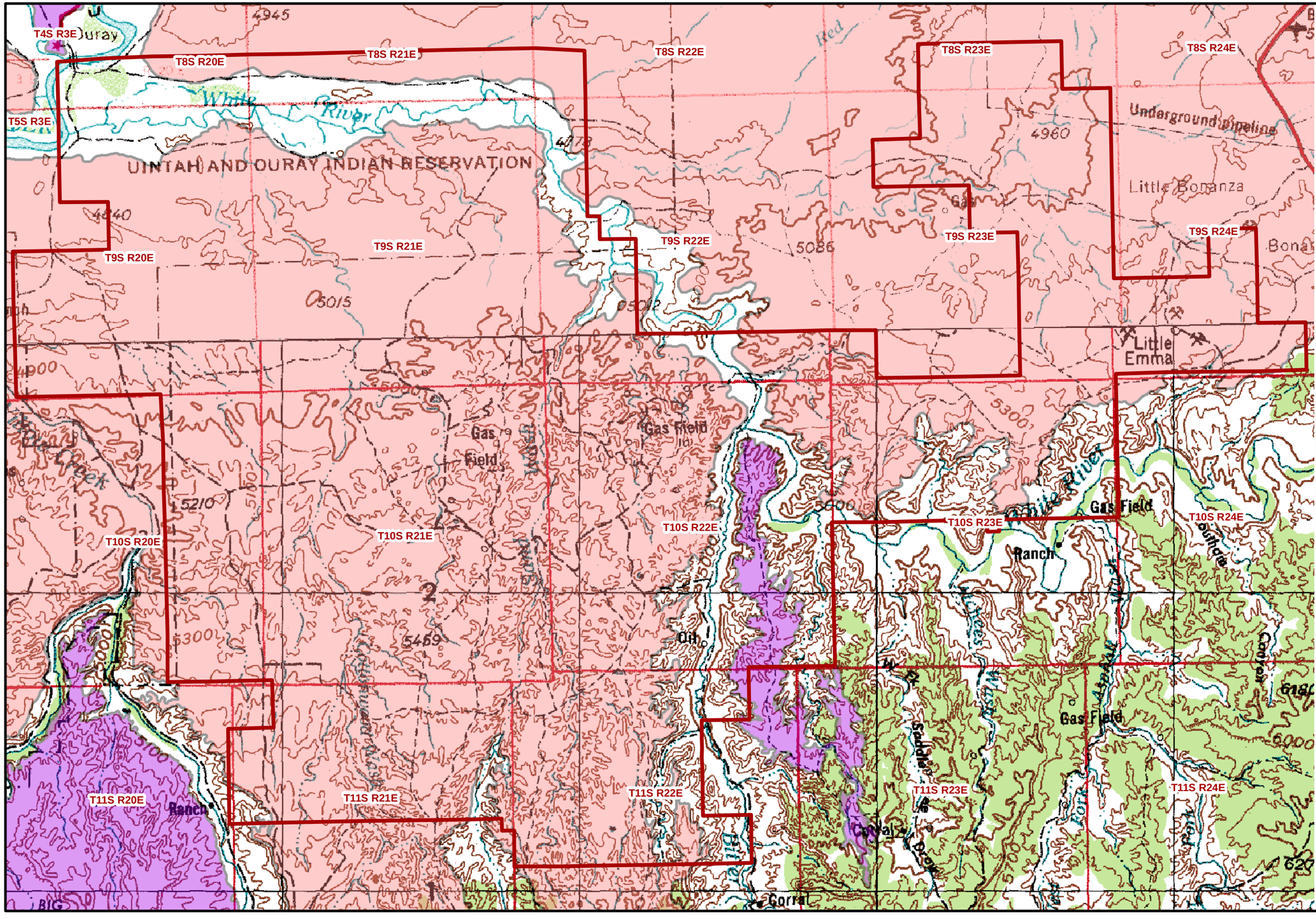
The UDWR reintroduced a herd of 45 bison into the Book Cliffs area southeast of the GNBPA during the winter of 2009. The Ute Tribe also owns a herd of approximately 400 bison to the west of the GNBPA. However, due to expanding populations, animals from these populations occasionally may wander into the GNBPA as suitable habitat is present in the majority of the GNBPA (UDWR 2007a). Bison year-long crucial habitat is found throughout the GNBPA south of the White River. Designated bison habitat is presented in **Figure 3.15-5.**

Black bear and mountain lion also are classified as big game species in Utah. Mountain lions are fairly common throughout Utah and occupy all habitat types in the project region (UDWR 2007b). They often travel between mountain ranges and valleys depending on prey availability. Black bears are largely absent from most of the GNBPA but may inhabit higher elevations south of the GNBPA and riparian habitat along the White River and Bitter Creek (Black and Auger 2004; UDWR 2007c).

Small Game and Furbearers

Other important game species within the GNBPA include upland game birds consisting primarily of greater sage-grouse, mourning dove, wild turkey, ring-necked pheasant, and chukar (BLM 2008c). The greater sage-grouse is classified as a federal candidate species and is discussed further in Section 3.15.1.3, Special Status Wildlife Species. The mourning dove is a spring and summer resident that typically is associated with open upland communities and agricultural areas (Stokes and Stokes 1996). Ring-necked pheasant and wild turkey occur in low numbers in the agricultural areas and riparian corridors along the White River and Green River (BLM 2008c). Low numbers of chukar inhabit steep slopes and ephemeral drainages in the vicinity of water (BLM 2008c). Other small game species within the GNBPA include cottontail rabbit and black-tailed jackrabbit (BLM 2008c).

The GNBPA is located within the Pacific Flyway (USFWS 2007d). Waterfowl habitat is limited to ponds and wetlands along the Green River, White River, and Bitter Creek. Waterfowl species that may be found within the GNBPA include Canada goose, mallard, gadwall, cinnamon teal, blue-winged teal, green-winged teal, northern pintail, American wigeon, northern shoveler, and ruddy duck (BLM 2008c; Stokes and Stokes 1996). Waterfowl numbers typically peak during the fall and winter months as suitable nesting habitat is limited within the GNBPA; therefore, limiting bird numbers during the spring and summer. Pelican Lake and Ouray National



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UINTAH AND OURAY INDIAN RESERVATION

White River

Red

Underground pipeline

Little Bonanza

Little Emma

Gas Field

Ranch

Corral

Utah

Area of Detail

Uintah County

LEGEND

- EIS Project Area

Mule Deer Habitat

- Year-long crucial
- Winter substantial
- Winter crucial

N

Scale in Miles

Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.15-2

Mule Deer Habitat

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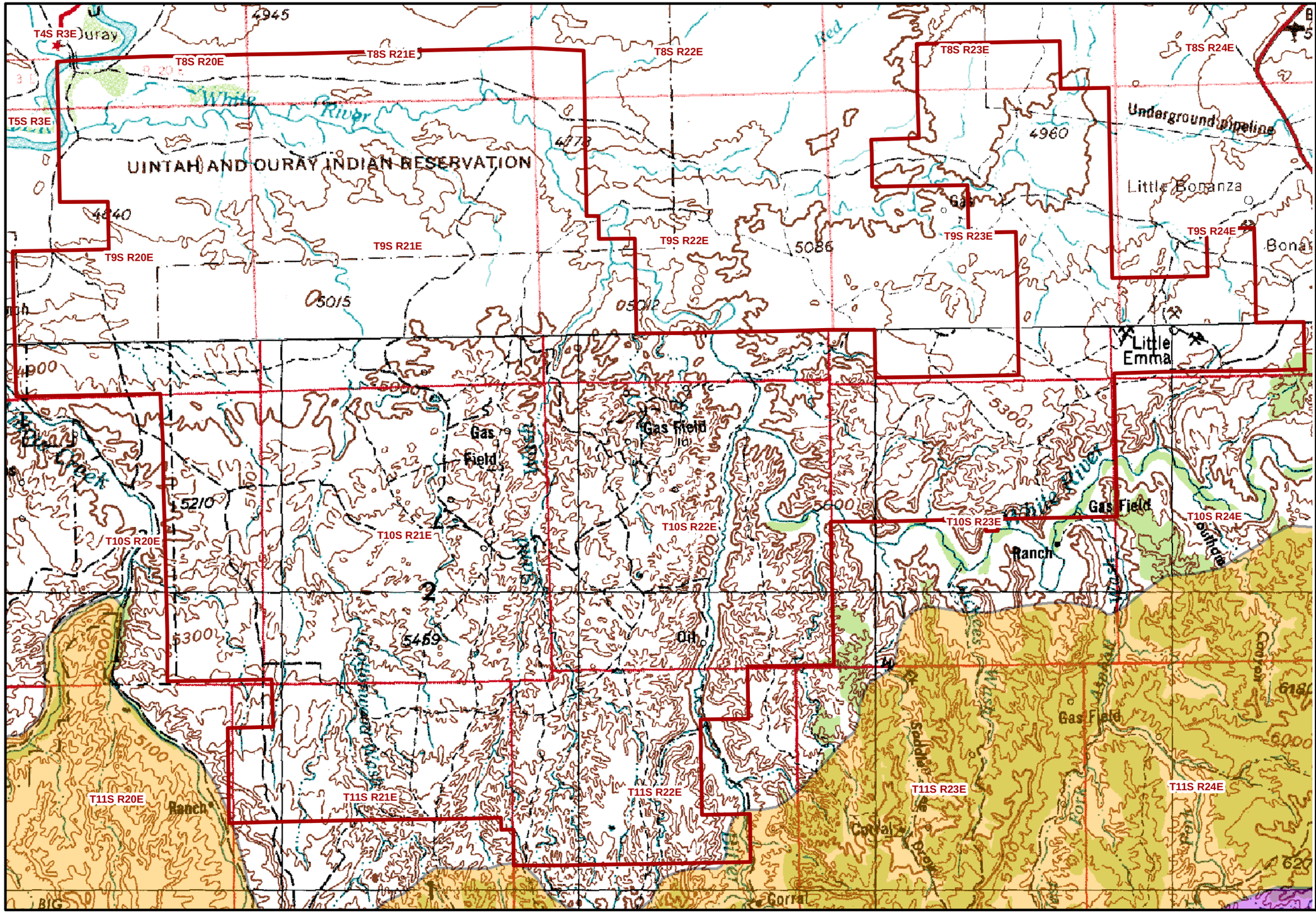

LEGEND

- EIS Project Area

Elk Habitat

- Winter crucial
- Winter substantial

N

Scale in Miles: 1 0.5 0 1 2

Scale in Kilometers: 2 1.5 1 0.5 0 2

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.15-3

Elk Habitat

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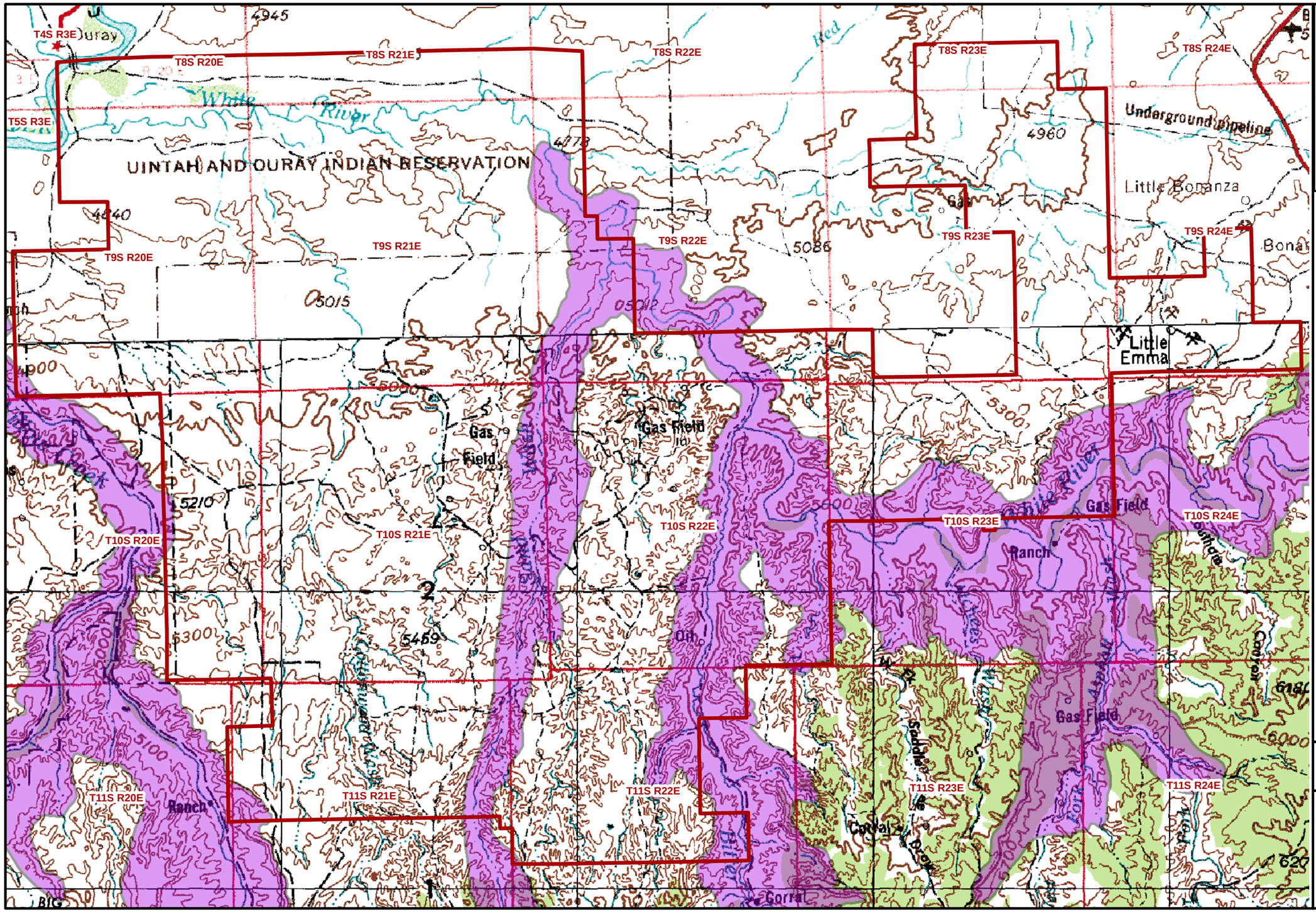

LEGEND

EIS Project Area

Rocky Mountain Bighorn Sheep Habitat

Year-long crucial

N

Scale in Miles

Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.15-4

Rocky Mountain Bighorn Sheep Habitat

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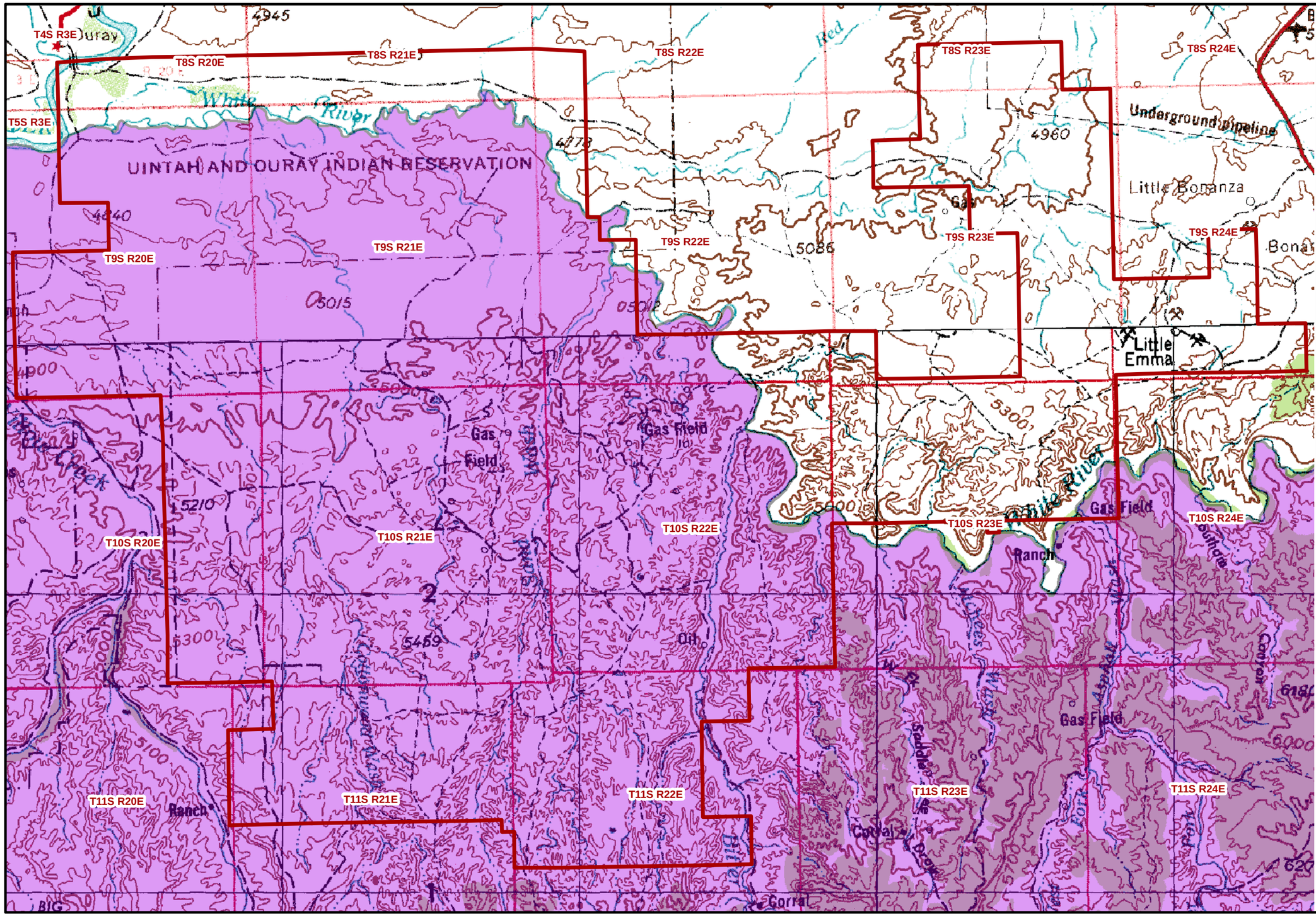

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.15-5

Bison Habitat

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Wildlife Refuge northwest of the GNBPA are important wintering areas for waterfowl as the Green River serves as a migration corridor for much of the waterfowl in eastern Utah.

Furbearers that may be found within the GNBPA include bobcat, coyote, raccoon, beaver, gray fox, badger, mink, muskrat, striped skunk, western spotted skunk, ringtail, and weasel (BLM 2008c; UDWR 2007d). Due to greater vegetation diversity, many of these species are most prevalent along the Green River, White River, and Bitter Creek riparian corridors.

3.15.1.2 Nongame Species

A diversity of nongame species (e.g., small mammals, raptors, passerines, amphibians, and reptiles) occupies a variety of trophic levels and habitat types. Nongame mammal species occurring within the GNBPA include a variety of shrews, bats, ground squirrels, rabbits, woodrats, and mice. Prairie dog species in northeastern Utah are limited for the white-tailed prairie dog. UDWR and the BLM have not conducted surveys for white-tailed prairie dog colonies within the entire GNBPA boundary. Limited survey data shows small, scattered colonies are present, especially in the northeast corner of the GNBPA (**Figure 3.15-6**). However, potential prairie dog habitat does exist within other portions of the GNBPA. The white-tailed prairie dog is a sensitive species and is discussed further in Section 3.15.1.3, Special Status Wildlife Species. Small mammals provide a substantial prey base for the areas predators including mammals (coyote, fox, badger, skunk), raptors (eagles, buteos, and owls), and reptile species.

Reptiles and amphibians potentially found within the project region include wandering garter snake, Great Basin gopher snake, western whiptail, sagebrush lizard, short-horned lizard, Great Basin spadefoot toad, Woodhouse's toad, and northern leopard frog (BLM 2008c). Although all of these species are important members of wildland ecosystems and communities, most are common and have wide distributions within the region. Consequently, the relationship of most of these species to the proposed project is not discussed in the same depth as species that are threatened, endangered, sensitive, of special economic interest, or are otherwise of high interest or unique value.

Migratory Birds

Migratory birds are protected under the MBTA (16 USC 703-711) and EO 13186 (66 Federal Register 3853). Pursuant to EO 13186, a draft Memorandum of Understanding among the BLM, USFS, and USFWS was drafted in order to promote conservation and protection of migrating birds. Specific measures to protect migratory bird species and their habitats have not been identified within EO 13186, but instead, the EO provides guidance to agencies to promote best management practices for the conservation of migratory birds.

A wide variety of migratory birds are found within the GNBPA. These species are associated with a variety of habitat types, and many occur within the project vicinity year-round. Several of the more common species found within the GNBPA include horned lark, common raven, black-billed magpie, western kingbird, cliff swallow, and chipping sparrow (BLM 2008c). Other bird species that could occur within wetlands and riparian areas along the Green River, White River, and Bitter Creek include great blue heron, pied-billed grebe, killdeer, and spotted sandpiper. Details on sensitive species such as Lewis' woodpecker, and yellow-billed cuckoo are discussed further in Section 3.15.1.3, Special Status Wildlife Species.

Raptors

Common raptor species that breed in the project region include the golden eagle, ferruginous hawk, red-tailed hawk, Cooper's hawk, sharp-shinned hawk, northern harrier, prairie falcon, American kestrel, great-horned owl, burrowing owl, and long-eared owl (BLM 2008c). Short-eared owls also occur but are less common in the region (BLM 2008c). Raptor nest data was compiled from field surveys and data provided by the UNHP, UDWR, and KMG (Buys & Associates 2006a,b). A total of 110 nest sites have been identified within the GNBPA. The majority of these nests are golden eagle, red-tailed hawk, or prairie falcon.

Most identified nest sites within the GNBPA were located on promontory points (e.g., mesa tops, cliff faces, rock outcrops) in areas with slopes greater than or equal to 30 percent. Some raptor species (e.g., great-horned owl, red-tailed hawk) also utilize pinyon-juniper woodlands and deciduous trees (e.g., cottonwood, boxelder, and Russian olive trees) for nesting; however, these resources are limited within the GNBPA. According to SWReGAP data, the GNBPA includes approximately 2,851 acres of pinyon-juniper woodlands located at the higher elevations within southern portions of the GNBPA. Large deciduous trees are limited to cottonwood trees along the White River and Green River riparian corridors. Northern harriers and short-eared owls, which are ground nesters, often utilize heavily vegetated washes with sage and greasewood for nesting.

Birds of Conservation Concern and Partners in Flight Priority Bird Species

A list of Birds of Conservation Concern (BCC) was developed as a result of a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that the USFWS "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." The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions, and that these species would be consulted on in accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (USFWS 2008a, 2002a). Important bird species that potentially could occur within the GNBPA and their associated habitat types are presented in **Appendix I**. The GNBPA is located within BCC Region 16 (Southern Rockies/Colorado Plateau) and also contains a small portion of the Upper Green River Bird Habitat Conservation Area (BHCA). This area contains the largest contiguous tract of lowland riparian habitat in Utah and is a major migration corridor for all bird species (Utah Partners in Flight [PIF] 2005). The BHCA contains important habitat for the yellow-billed cuckoo and other riparian obligate species.

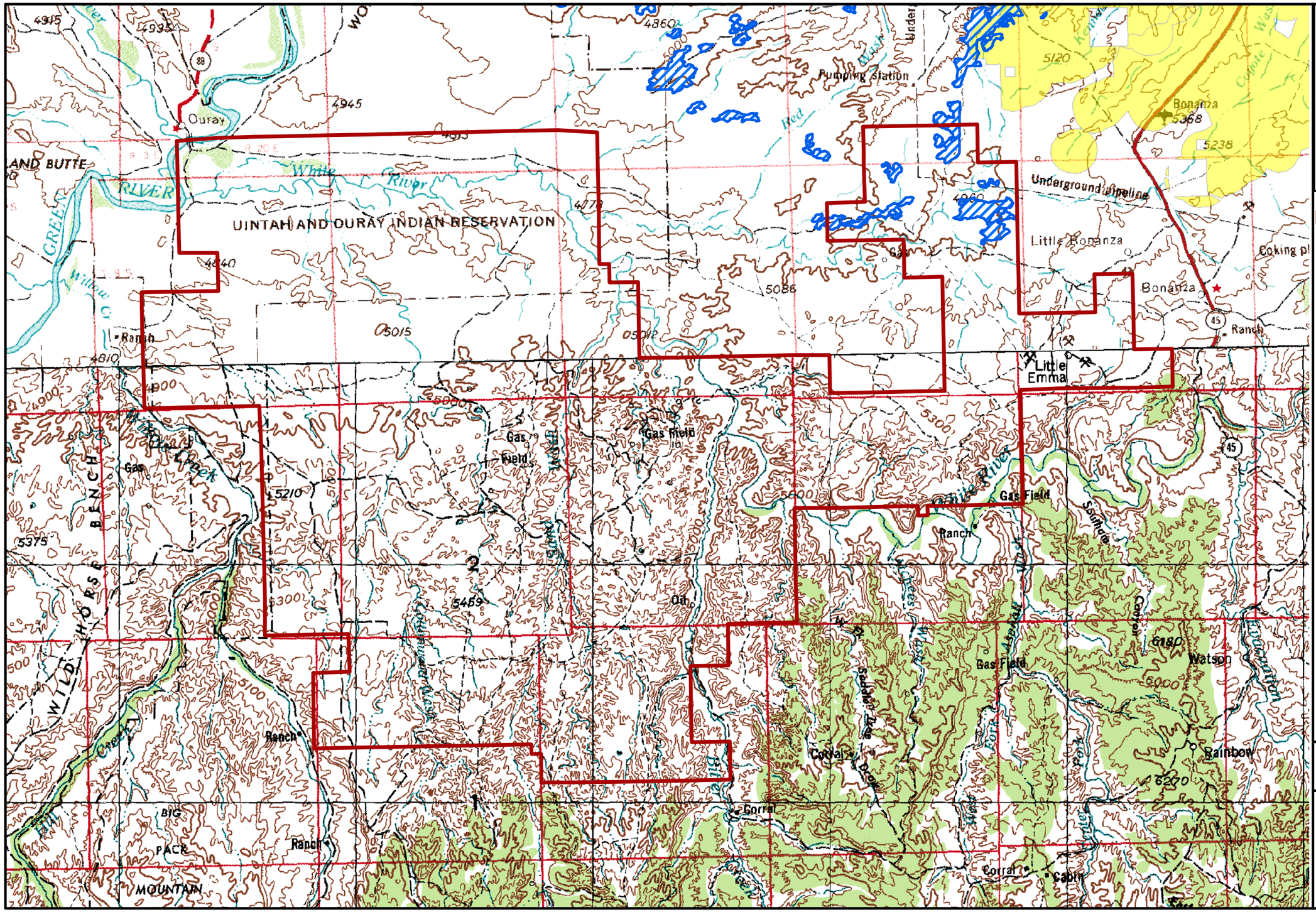
PIF is a multi-faceted organization with the goal of documenting and reversing population declines of neotropical migratory birds and their habitats. PIF Priority Bird Species that potentially could occur within the GNBPA and their associated habitat types are presented in **Appendix I**.

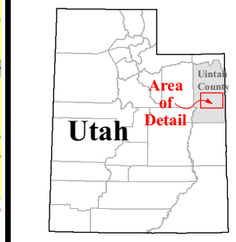
3.15.1.3 Special Status Wildlife Species

Special status wildlife species include those wildlife species federally listed as threatened, endangered, proposed, and/or candidate, as well as BLM sensitive species and State of Utah species of concern. The ESA provides protection to federally listed threatened, endangered, and proposed species from any action that may jeopardize their existence.

In accordance with the ESA, as amended, the lead agency in coordination with USFWS must ensure that any federal action to be authorized, funded, or implemented would not adversely affect a federally listed threatened or endangered species or its critical habitat. Special Status Species Management Policy 6840 requires the BLM to manage and protect BLM sensitive species, which include: species listed or proposed for listing under the ESA; species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA; species designated as BLM sensitive by the State Director; and all federal candidate species, proposed species, and delisted species in the 5 years following delisting. This policy requires the BLM to manage and protect BLM sensitive species to prevent the need for future federal listing as threatened or endangered.

Twenty-five special status wildlife species were identified by the USFWS, the State of Utah, and the BLM as potentially occurring within the GNBPA (UDWR 2006b; Crist 2007). These species, their scientific names, status, associated habitats, and their potential for occurrence within the GNBPA are summarized in **Appendix H**. Occurrence potential within the GNBPA was evaluated for each of these species based on their habitat requirements and/or known distribution. Based on these evaluations, nine terrestrial wildlife species have been eliminated from detailed analysis as their known range is outside of the GNBPA, and/or the GNBPA does not include suitable habitat for these species. The species eliminated from analysis include Canada lynx, Mexican spotted owl, mountain plover, American white pelican, bobolink, three-toed woodpecker, big





EIS Project Area

Glen Bench/Coyote Wash Prairie Dog Complex

Coyote Basin/Myton Prairie Dog Complex

N

1.25 0.625 0 1.25 2.5
Scale in Miles

2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.15-6

White-tailed Prairie Dog Colonies

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free-tailed bat, northern goshawk, and boreal toad. The remaining 16 species that have a potential to occur within the GNBPA are discussed below.

Black-footed Ferret

The black-footed ferret is federally listed as an endangered species. The only known populations of black-footed ferrets are either captive or have been reintroduced, with no natural wild populations known to occur (USFWS 1998). The species utilizes semi-arid grasslands and mountain basins primarily associated with prairie dog colonies. The historic range of the species included the Rocky Mountain and Western Great Plains regions (Fitzgerald et al. 1994). In Utah, the distribution of this species is limited to a nonessential experimental population reintroduced into Coyote Basin within Uintah County (USFWS 1998). Seventy-one ferrets were first reintroduced into Coyote Basin in 1999. By November 2007, a total of 313 ferrets had been reintroduced into Coyote Basin and the area around Snake John. The ferret population currently is holding steady at 10 to 15 adult ferrets in Coyote Basin. The black-footed ferret population mimics the prairie dog population: it rebounded after a crash in 2003 to 2004 and has held steady for the past 5 years (Maxfield 2009). The nearest Coyote Basin prairie dog colonies are approximately 1.5 miles northeast of the project. An unconfirmed observation of an individual was reported in Kennedy Wash within the GNBPA, and individuals have been documented outside of the Primary Management Zone in other areas within the Uinta Basin including a reported credible sighting of a ferret on Tribal ground west of Fantasy Canyon (BLM 2008c; Maxfield 2009, UDWR 2007e). Black-footed ferrets in Uintah County are managed as an experimental non-essential population under Section 10j of the ESA. Small scattered white-tailed prairie dog colonies also are present in the northeast corner of the GNBPA (**Figure 3.15-6**). These prairie dog colonies are not considered part of the Coyote Basin prairie dog complex. However, because of the close proximity to Coyote Basin, the potential for occurrence within the eastern portion of the GNBPA is high.

Fringed Myotis

The fringed myotis is listed as a wildlife species of concern by the UDWR, as well as a BLM sensitive species. This species occurs from low desert scrub to fir-pine associations and oak and pinyon-juniper woodlands at 2,400 to 8,900 feet elevation (Oliver et al. 2009). This species roosts in caves, mines, and buildings and is most commonly associated with water courses and lowland riparian areas (UDWR 2006b). Females mate in the fall and ovulation and fertilization occur in late April and May (Fitzgerald et al. 1994). In Utah, this species is known to occur in Washington, Garfield, Kane, San Juan, Uintah, and Grand counties (UDWR 2006b). A few scattered observations of the species have been documented in Uintah County. Suitable riparian and pinyon-juniper woodlands habitats are present within the GNBPA. Roosting locations likely are to be present although none have been identified by UDWR or BLM. The species has not been documented within the GNBPA; however, based on the known range and the presence of suitable habitats, this species is likely to occur within the GNBPA. The potential for occurrence in the GNBPA is moderate.

Spotted Bat

The spotted bat is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species occurs in montane forests, pinyon-juniper woodlands, and open semi-desert shrublands at 2,700 to 9,200 feet elevation (Oliver et al. 2009). This species utilizes crevices in rocky cliffs for roosting habitat, ponderosa pine woodlands during the reproductive season, and lower elevations at other times of the year (Fitzgerald et al. 1994). This species is believed to occur throughout the state in appropriate habitats (Oliver et al. 2009; UDWR 2006b). This species is rare in Utah and it has not been documented within the GNBPA; however, its presence in Uintah County is likely (UDWR 1998). In addition, potentially suitable habitats for this species are present within the GNBPA. The potential for occurrence in the GNBPA is moderate.

Townsend's Big-eared Bat

The Townsend's big-eared bat is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species occupies semi-desert shrublands, pinyon-juniper woodlands, and open montaine forests at 3,300 to 8,851 feet elevation (Oliver et al. 2009). This species utilizes caves and abandoned mines for day roosts, but also uses abandoned buildings and rock crevices for refuge (Fitzgerald

et al. 1994). This species occurs throughout Utah including Uintah County (UDWR 1998). One individual was collected at the Ouray National Wildlife Refuge northwest of the GNBPA (BLM 2008c). Roosting habitat within the GNBPA may be present in rock cliffs and caves. The potential for occurrence within the GNBPA is moderate.

White-tailed Prairie Dog

The white-tailed prairie dog is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species, and has been petitioned to be federally listed as threatened or endangered under the ESA. Colonies of this species occur primarily in mountain valleys, semi-desert grasslands, and open shrublands (Fitzgerald et al. 1994). They are distributed in relatively large, sparsely populated complexes and live in loosely knit clans (UDWR 2006b). In Utah, the white-tailed prairie dog occurs predominantly in the Uinta Basin and the northern part of the Colorado Plateau. This species is the main food source of the endangered black-footed ferret (Fitzgerald et al. 1994). Small white-tailed prairie dog colonies have been observed within the GNBPA. Prairie dog colony mapping has been conducted by UDWR and the BLM over portions of the GNBPA (**Figure 3.15-6**); however, no prairie dog surveys have been conducted on Tribal Lands (UDWR 2007f). Colonies found within the GNBPA are not associated with the Coyote Basin Black Footed Ferret Reintroduction complex.

Bald Eagle

The bald eagle is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species commonly roosts in conifers or other sheltered sites in the winter and typically selects the larger, more accessible trees. Breeding habitat for this species typically is found in areas with an adequate supply of fish and/or waterfowl and nearby nesting sites (Johnsgard 1990). This species can be sensitive to disturbance during the nesting period and tends to choose nesting locations sheltered from disturbance (Johnsgard 1990). Recent surveys have shown that more than 1,200 bald eagles occupy Utah during the winter (UDWR 2009a). This accounts for approximately 25 to 30 percent of the western population of wintering bald eagles in the U.S. Within the Vernal Field Office boundary, this species is known to winter mainly along the Green River, although smaller wintering populations occupy portions of the White River (BLM 2008c). As of spring 2009, the number of nesting bald eagle pairs in Utah remains low, and no bald eagle nests or nesting attempts have been documented within the GNBPA (Maxfield 2009). The nearest documented bald eagle nests are located on the Uinta River northeast of Duchesne and on the White River east of the Utah/Colorado state line (Maxfield 2009). Due to the presence of known wintering populations along the Green and White rivers, the potential for occurrence within the GNBPA is high.

Burrowing Owl

The burrowing owl is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species habitat includes open grassland and prairies (BLM 2008c). They nest in underground mammal burrows, and are often associated with prairie dog colonies (UDWR 2006b). Burrowing owls have been documented nesting on both sides of the White River within the Vernal Field Office boundary. This species is likely to be present within the GNBPA during the breeding season (March 1 to August 31); therefore, nesting is expected to occur in suitable habitats within the GNBPA.

Ferruginous Hawk

The ferruginous hawk is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species habitat includes grasslands, agricultural lands, sagebrush/saltbush/greasewood, shrublands, and the periphery of pinyon-juniper woodlands. In Utah, the breeding season for ferruginous hawks is March 1 to August 1. Nesting habitat includes trees, cliffs, and buttes in close proximity to areas with a large prey base such as prairie dogs and jackrabbits (Johnsgard 1990). This species is known to nest north of the GNBPA and the nearest nest UDWR has recorded is approximately 1 mile from the GNBPA boundary (Maxfield 2009). As of spring 2009, no ferruginous hawk nests have been identified within the GNBPA (Maxfield 2009). However, due to suitable foraging habitat present throughout the Uintah Basin, the species is likely to occur within the GNBPA.

Grasshopper Sparrow

The grasshopper sparrow is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species occurs in dry grasslands characterized by short to mid-height clumps of grass with few to no shrubs. The grasshopper sparrow is known to occur in most of the U.S. in summer, but is limited to the southern states and Mexico during winter months (UDWR 2006b). The main concentration of the species occurs in the Great Plains from North Dakota south to northern Texas. The only known occurrences of the species in Utah are documented in the northernmost region of the state (UDWR 2006b). Occurrences have not been documented within the GNBPA, and the potential for occurrence within the GNBPA is low.

Greater Sage-grouse

The greater sage-grouse is listed as a federal candidate species, a wildlife species of concern by the UDWR, and a BLM sensitive species. On March 5, 2010, the USFWS determined that the greater sage-grouse warrants protection under the ESA; however, the USFWS concluded that proposing the species for protection is precluded by the need to take action on other species facing more immediate and severe extinction threats. Therefore, greater sage-grouse in Utah continue to be managed by the UDWR, while most of their habitat is located on federal or private lands. Conservation efforts for this species in Utah currently are coordinated by the UDWR in cooperation with the USFWS, BLM, and regional greater sage-grouse working groups in an attempt to increase population levels and avoid federal listing under the ESA. Greater sage-grouse have the lowest reproductive potential of any North American gamebird; therefore, populations may be less able to recover from population declines as quickly as most other game birds (UDWR 2009b).

In Utah, the greater sage-grouse inhabits upland sagebrush grasslands, foothills, and mountain valleys (BLM 2008c; UDWR 2009b). This species occupies different habitat types during the year depending on season, weather, and nutritional requirements. In general, the following three categories are used to classify greater sage-grouse habitat.

Lekking/Nesting Habitat

The center of breeding activity for greater sage-grouse is referred to as a strutting ground or lek. Leks are characterized as flat, sparsely vegetated areas within large tracts of sagebrush (Connelly et al. 2004; UDWR 2009b, 2006b). Males begin to appear on leks in late February/early March with peak attendance of Utah leks occurring in April (UDWR 2009b). To protect greater sage-grouse leks from surface disturbance, the Vernal RMP requires a 0.25-mile NSO around active leks (BLM 2008c). More recent literature in Colorado and Wyoming suggests that a 0.25-mile NSO is insufficient to prevent disturbance to strutting males, and that a 0.6-mile NSO should be used instead (Colorado Division of Wildlife [CDOW] 2008). Greater sage-grouse nesting habitat typically is centered around active leks and consists of medium to tall sagebrush with a perennial grass understory (Connelly et al. 2000). Studies have shown that taller sagebrush with larger canopies and more residual understory cover usually lead to higher nesting success (UDWR 2009b). Connelly et al. (2000) recommends establishing a 2-mile buffer with timing restrictions around leks to protect nesting hens (up to 80 percent) in non-migratory populations. The Vernal RMP requires a timing restriction for surface disturbing activities from March 1 to June 15 within 2 miles of an active lek (BLM 2008b). Recent literature pertaining to Colorado and Wyoming suggests that a 2-mile buffer is inadequate as it only protects 52 percent of nesting hens while a 4-mile buffer protects up to 80 percent of nesting hens (CDOW 2008).

Brooding Habitat

During the late spring and summer, hens and broods typically are found in more lush habitats consisting of a high diversity of grasses and forbs that attract insects (Connelly et al. 2004). These habitats include wet meadows, riparian areas, and irrigated farmland within or near sagebrush (UDWR 2009b). Hens with broods will utilize these habitats until forbs desiccate and insect abundance decreases (Connelly et al. 2004). Unsuccessful hens and cocks also will utilize these same habitats; however, due to their nutritional flexibility, they are able to occupy a wider variety of habitats during the spring and summer months (Connelly et al. 2004). In many greater sage-grouse populations, high quality brooding habitat is often the limiting factor due to drought, invasive weeds, and overgrazing associated with improper range management.

Wintering Habitat

Depending on the severity of the winter, greater sage-grouse will move to south- and east-facing slopes that maintain exposed sagebrush. Studies have shown that south-facing slopes with sagebrush at least 10 to 12 inches above the snow level are required for both food and cover (UDWR 2009b). Windswept ridges, draws, and swales also may be used, especially if these areas are in close proximity to exposed sagebrush (Connelly et al. 2004). A study in Utah indicated that greater sage-grouse preferred sagebrush habitats with medium to tall (40 to 60 centimeters) sagebrush and 20 to 30 percent canopy cover (Homer et al. 1993). In years with severe winter conditions (i.e., deep snow), greater sage-grouse will often gather in large flocks in areas with the highest quality winter habitat. It is suggested that high quality winter habitat is limited in portions of the greater sage-grouse's range (Connelly et al. 2000).

Greater sage-grouse nesting, brooding, and wintering habitats within the GNBPA are presented in **Figure 3.15-7**. Approximately 61,744 acres of brooding habitat; 23,380 acres of nesting habitat; and 46,969 acres of wintering habitat occur within the GNBPA. However, these estimates are conservative and are based on vegetation type, height, and composition. It is likely that habitat currently utilized by greater sage-grouse within the GNBPA is much smaller and centered around the active leks in the southern portion of the GNBPA (East Bench and Middle Bench areas). The UDWR has identified a total of four leks (East Bench 16, East Bench NE, Middle Bench Guzzler, and Sand Wash Rim) within the GNBPA, with a fifth lek (East Bench) located approximately 1 mile south of the GNBPA boundary. **Table 3.15-1** presents the greater sage-grouse lek counts over the past 10 years for these 5 leks (Maxfield 2009).

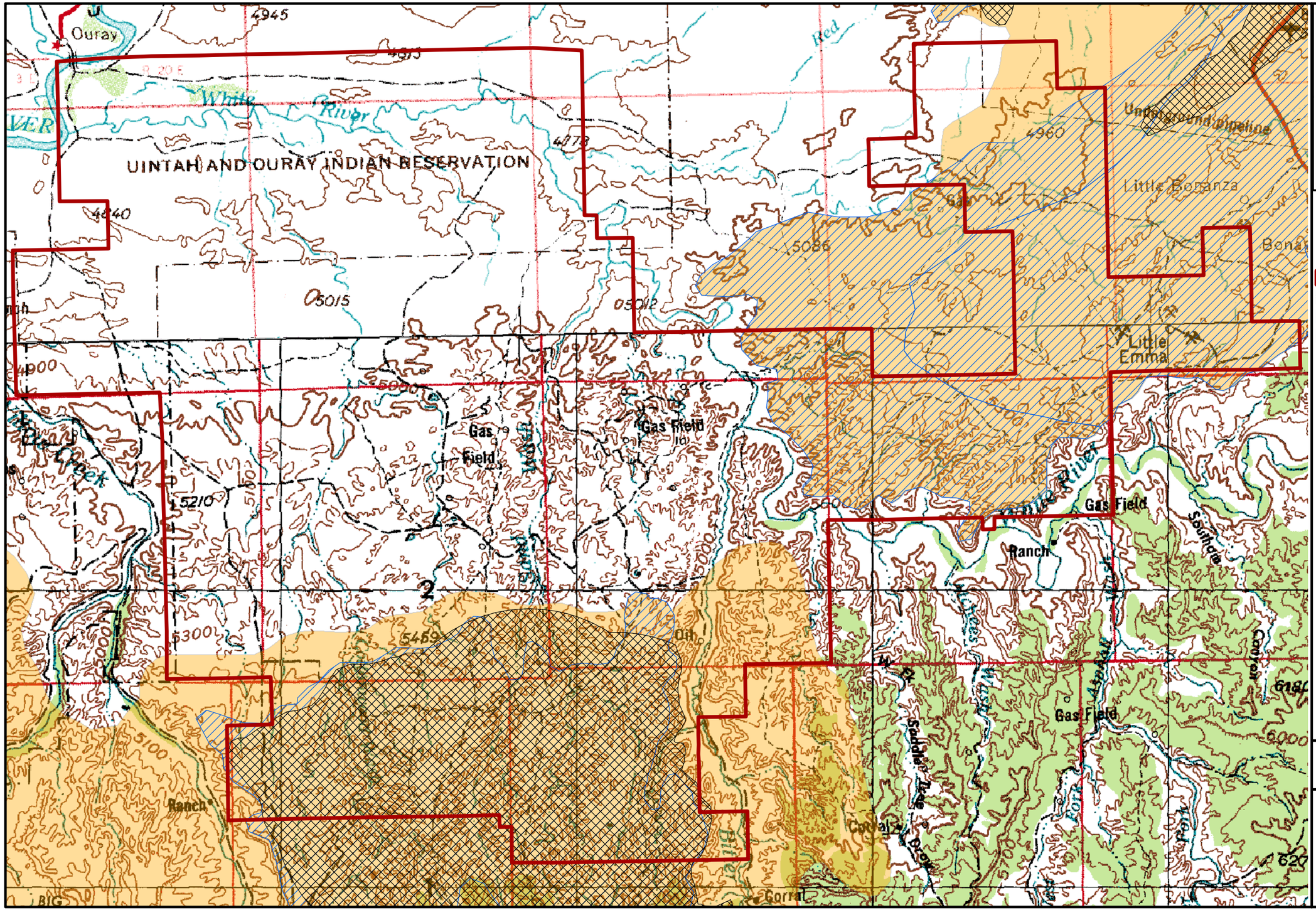
Table 3.15-1 Greater Sage-grouse Lek Counts (males only) from 1999-2009

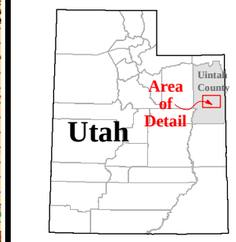
Lek Name	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	10-Year Average
East Bench 16[1]	-	-	-	-	-	5	10	6	5	0	0	4.3
East Bench NE	12	14	18	0	0	0	0	0	0	0	0	4.0
Middle Bench Guzzler[1]	-	-	-	-	-	-	5	0	5	3	0	2.6
Sand Wash Rim[1]	29	24	-	27	12	14	19	20	17	8	9	17.9
East Bench[1]	0	0	0	0	0	5	0	0	0	0	-	0.5
Total	**41**	**38**	**18**	**27**	**12**	**24**	**34**	**26**	**27**	**11**	**9**	**24.3**

[1] A dash indicates that the lek was not surveyed that year.

As of fall 2009, the East Bench population was estimated at approximately 50 to 60 greater sage-grouse (Maxfield 2009). Prior to a research study conducted in 2007 and 2008, the East Bench population was estimated at approximately 200 individuals (Smith 2009). Because the East Bench and Middle Bench areas provide critical habitat for lekking, nesting, early brood-rearing, and wintering, UDWR conducted a research study in 2007 and 2008 on the East Bench greater sage-grouse population using radio telemetry (Maxfield 2009; Smith 2009). This study found that nesting/early brood rearing occurred on the East Bench and Middle Bench areas. Hens with broods then moved to the Willow Creek drainage during the summer months. Within the Willow Creek drainage, adult and chick survival was poor, and mortalities during the summer and fall months were high, possibly due to predation (Maxfield 2009; Smith 2009). Smith (2009) documented greater sage-grouse mortality as a result of both mammalian and avian predators. Mortality was lower when greater sage-grouse occupied the East Bench and Middle Bench areas. In 2007 and 2008, annual mortality for greater sage-grouse in the East Bench population was greater than 60 percent (Smith 2009). Smith (2009) also found that all radio-marked greater sage-grouse spent the winter within the East Bench and Middle Bench areas, both of which are currently being developed.

The greatest threat to greater sage-grouse within the GNBPA is habitat loss and fragmentation associated with energy development. The Uinta Basin population of greater sage-grouse, specifically the East Bench population, has shown a steady decline over the past 10 years; much like many other greater sage-grouse populations in Utah. This decline may correspond with the increase in energy development within the Uinta





EIS Project Area
Sage Grouse Nesting
Sage Grouse Wintering
Sage Grouse Brooding

N

1 0.5 0 1 2
Scale in Miles
2 1.5 1 0.5 0 2
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 3.15-7

Greater Sage-grouse Habitat

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Basin since the late 1990s. Currently, four other energy development projects (KMG Love Unit EA, Enduring Resources Big Pack EA, XTO Little Canyon EA, and Resource Development Group [RDG] Uinta Basin EIS) are occurring or are in the BLM review process within and around the East Bench and Middle Bench areas (BLM 2008g, 2006c). In addition, several other smaller energy development projects (e.g., exploratory wells, pre-NEPA oil and gas leases) occur in the East Bench and Middle Bench areas. Other threats to greater sage-grouse within the Uinta Basin include the spread of invasive weeds, overgrazing, pinyon-juniper encroachment into sagebrush habitat, and poor reclamation due to drought. Overall, greater sage-grouse habitat quality and quantity has declined throughout Utah, which coincides with reduced greater sage-grouse populations (Connelly et al. 2004; UDWR 2009b).

Lewis' Woodpecker

The Lewis' woodpecker is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species is a cavity nester and requires large, open pine forests for foraging. The species diet consists primarily of insect prey during breeding season and nuts and berries at other times of the year (UDWR 2006b). Breeding habitat includes ponderosa pine and open riparian areas. Winter habitat includes open woodlands and lowland riparian areas (UDWR 2006b). This species is occasionally found in the riparian habitats of the Uinta Basin and along the Duchesne, White, and Green rivers (BLM 2008c). This species has been documented within the GNBPA in riparian areas along portions of the White River and Green River (UDWR 2007f).

Long-billed Curlew

The long-billed curlew is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species habitat includes dry uncultivated rangelands and pastures near water (BLM 2008c). Long-billed curlews forage in moist meadow wetlands and upland habitats. Habitat for this species occurs at mid-elevations from the Uinta Mountains in northern Utah to the Book Cliffs in east-central Utah. This species has been observed in the GNBPA and is known to nest within the GNBPA (BLM 2008c; UDWR 2007f).

Short-eared Owl

The short-eared owl is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species occupies open habitats such as fields, pastures, marshes, hay meadows, grassland, and tundra (Johnsgard 2002). The species is associated with open country that is found throughout the GNBPA. This species has been documented within the GNBPA in Cottonwood Wash.

Western Yellow-billed Cuckoo

The western yellow-billed cuckoo is a federal candidate species, a wildlife species of concern by the UDWR, and a BLM sensitive species. This species nests in dense lowland riparian vegetation of regeneration canopy trees, willows, or other riparian shrubs that occur within 100 meters of water (Parrish et al. 2002). This species typically nests from late May through July. The western yellow-billed cuckoo is known to occur at the Ouray Natural Wildlife Refuge and along the Green and White rivers (UDWR 2007f). Potential habitat for this species within the GNBPA would be limited to the riparian corridors along the Green and White rivers. The potential for occurrence within the GNBPA is moderate.

Corn Snake

The corn snake is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species occurs in a variety of habitats along stream courses, rocky wooded hillsides, canyons and arroyos, and in coniferous forests (BLM 2008c). This species has been documented within the GNBPA in suitable habitats.

Smooth Greensnake

The smooth greensnake is listed as a wildlife species of concern by the UDWR as well as a BLM sensitive species. This species inhabits moist grassy areas and meadows. The known distribution of this species ranges

from northeast Utah into central Colorado (BLM 2008c). This species is known to occur in Uintah County (UDWR 1998), and suitable habitat for this species is present within the GNBPA along the Green and White rivers.

3.15.2 Fisheries Resources

3.15.2.1 Aquatic Habitat and Species

Aquatic habitat in the GNBPA consists mainly of intermittent and ephemeral streams. Within the GNBPA, the only drainages with perennial flow are the Green River and White River drainages, which consist of stream habitat and associated wetlands/ponds. The UDEQ designates the Green River near Ouray and the White River from the Green River confluence to the Colorado state line as warm water fisheries (Utah Administrative Code 2007). Game fish species found in the Green and White rivers include channel catfish, smallmouth bass, crappie, bluegill, green sunfish, black bullhead, northern pike, walleye, carp, and the occasional trout (Monroe 2007). However, channel catfish were the most abundant game species identified from electrofishing and fyke/trammel net surveys (Bestgen et al. 2007; Irving and Modde 1994). Other game fish species occur in relatively low numbers. Native fish species that occur in the Green and White rivers include Colorado pikeminnow (endangered), razorback sucker (endangered), bonytail (endangered), humpback chub (endangered), flannelmouth sucker (state sensitive), bluehead sucker (state sensitive), roundtail chub (state sensitive), mottled sculpin, and speckled dace (Monroe 2007). Native fish, such as flannelmouth sucker and bluehead sucker, and introduced species such as carp, channel catfish, and red shiner were the most abundant fish species identified during surveys (Bestgen et al. 2007; Irving and Modde 1994). The Colorado pikeminnow, razorback sucker, bonytail, humpback chub, flannelmouth sucker, bluehead sucker, and roundtail chub are sensitive species and discussed further under Special Status Fish Species.

The UDEQ designates Bitter Creek as a cold water fishery (Utah Administrative Code 2007) that supports a population of brook trout (Monroe 2007). However, Bitter Creek does not consistently provide adequate flow within the GNBPA. Therefore, it is unlikely that fish persist in Bitter Creek within the GNBPA (Monroe 2007).

3.15.2.2 Special Status Fish Species

Special status fish species include those fish species federally listed as threatened, endangered, proposed, and/or candidate, as well as BLM sensitive species and State of Utah species of concern. The ESA provides protection to federally listed threatened, endangered, and proposed species from any action that may jeopardize their existence.

In accordance with the ESA, as amended, the lead agency in coordination with USFWS must ensure that any federal action to be authorized, funded, or implemented would not adversely affect a federally listed threatened or endangered species or its critical habitat. Special Status Species Management Policy 6840 requires the BLM to manage and protect critical habitat. Special Status Species Management Policy 6840 requires the BLM to manage and protect BLM sensitive species, which include: species listed or proposed for listing under the ESA; species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA; species designated as BLM sensitive by the State Director; and all federal candidate species, proposed species, and delisted species in the 5 years following delisting. This policy requires the BLM to manage and protect BLM sensitive species to prevent the need for future federal listing as threatened or endangered.

Eight special status fish were identified as potentially occurring within the GNBPA (Crist 2007; UDWR 2006b). These species, their scientific names, status, associated habitats, and their potential for occurrence within the GNBPA are summarized in **Appendix H**. Occurrence potential within the GNBPA was evaluated for each of these species based on their habitat requirements and/or known distribution. Based on these evaluations, only the Colorado River cutthroat trout has been eliminated from further analysis. The other seven special status fish species with the potential to occur within the GNBPA are discussed below.

Bonytail

The bonytail is federally listed as endangered. This species habitat includes main channels of large rivers generally associated with swift currents. It typically is found in water depths of 3-4 feet with a shifting sand bottom. This species is only known to occur within the Green River (USFWS 2002b). No populations have been identified within the White River (Lentsch et al. 2000). This species may occur within the extreme northwestern corner of the GNBPA, and the USFWS has designated critical habitat within the Green River in Uintah County for this species (USFWS 2002b).

Colorado Pikeminnow

The Colorado pikeminnow is federally listed as endangered. This species is endemic to the Colorado River system and is known to migrate long distances and utilize pools, deep runs, and eddy habitats (USFWS 2002c). This species occurs in much of the Colorado River Basin and has been collected from the White River (Irving et al. 2003). This species is likely to occur within the GNBPA. The USFWS has designated critical habitat within the Green and White rivers in Uintah County for this species (USFWS 2002c).

Humpback Chub

The Humpback chub is federally listed as endangered. This species is endemic to the Colorado River system within deep, swift-running rivers, with canyon shaded environments (USFWS 2002d). The species has been documented within the Green River; however, no individuals have been identified in the White River (Irving et al. 2003). This species is likely to occur within the GNBPA. The USFWS has designated critical habitat within the Green River in Uintah County for this species (USFWS 2002d).

Razorback Sucker

The Razorback sucker is federally listed as endangered. Habitat for this species includes warm water reaches of large rivers in areas that include deep runs, eddies, backwaters, and flooded off channel environments (USFWS 2002e). This species is endemic to large rivers of the Colorado River Basin, including the Green and White rivers (USFWS 2002e). This species is likely to occur within the GNBPA. The USFWS has designated critical habitat within the Green and White rivers in Uintah County for this species (USFWS 2002e).

Bluehead Sucker

The Bluehead sucker is a species receiving special management under a conservation agreement in order to preclude the need for a federal listing. This species occurs in fast flowing water in high gradient reaches of mountain rivers and turbid or muddy, sometimes alkaline waters with vegetation absent or sparse (UDWR 1998). This species is known to inhabit the Colorado River drainage and is likely to occur in the Green and White rivers (UDWR 1998). This species is likely to occur within the GNBPA.

Flannelmouth Sucker

The flannelmouth sucker is a species receiving special management under a conservation agreement in order to preclude the need for a federal listing. This species inhabits large rivers, where they are often found in deep pools of slow-flowing, low-gradient reaches (BLM 2008c). This species is known to occur within the Green and White rivers (BLM 2008c). This species has been identified as one of the most common fish species captured in the White River during surveys (Lentsch et al. 2000). This species is likely to occur within the GNBPA.

Roundtail Chub

The roundtail chub is a species receiving special management under a conservation agreement in order to preclude the need for a federal listing. This species occurs in main channels of large rivers, and is most often found in murky pools near strong currents (BLM 2008c). This species occurs in much of the Colorado River system and is likely to be present in the Green and White rivers (UDWR 1998). This species is likely to occur within the GNBPA.