Chapter 3
Affected Environment

3.1 INTRODUCTION

This chapter describes the current condition of the existing human and natural environment in the PAPA and the degree to which specific resources have been affected by natural gas development. Relevant management objectives that the BLM advanced for each resource in the Pinedale RMP (BLM, 1988b) were reviewed for maintenance changes made since the RMP was first published. Maintenance changes are included in the annotated version of the RMP available online (BLM, 2006d). None of the management objectives included in the PAPA DEIS (BLM, 1999a) has changed. Relevant management objectives advanced by the BLM in the Green River RMP (BLM, 1997), the Kemmerer RMP (BLM, 1986), and in subsequent revisions were reviewed by resource. None of the management objectives included in the RMPs has changed; however, the Pinedale and Kemmerer RMPs are under revision. Management objectives for each of the three RMPs are not repeated here.

BLM Manual H-1790-1 (BLM, 1988a) lists critical elements that must be addressed in every EIS. These are:

- air quality;
- Areas of Critical Environmental Concern;
- cultural resources;
- environmental justice;
- farmlands;
- flood plains;
- invasive non-native species;
- migratory birds;
- Native American religious concerns;
- threatened or endangered species;
- wastes (hazardous or solid);
- water quality;
- wetlands/riparian zones;
- Wild and Scenic Rivers, and
- designated wilderness.

All of the aforementioned critical elements are potentially affected by implementation of each Alternative, with the exception of “Areas of Critical Environmental Concern” and “Wild and Scenic Rivers”. Each critical element is addressed in a level of detail commensurate with the degree of impact to the critical element or resource. A brief description is provided for resources that are expected to have minor impacts under the Alternatives. Detailed information is provided for resources that are expected to have significant impacts, consistent with guidance in BLM Manual H-1790-1 (BLM, 1988a).

For resources described in this chapter, repetition of pertinent information disclosed in the PAPA DEIS (BLM, 1999a) has been avoided. This chapter describes how each resource has been affected or altered since implementation of the PAPA ROD (BLM, 2000b).

The concept of SRMZs was developed in the PAPA DEIS (BLM, 1999a). A SRMZ is an area containing resources that require specific surface disturbance limitations, seasonal construction constraints, monitoring, or other actions to ensure that undue impacts to the resource do not occur. SRMZs occupy distinct geographic areas and in many cases, SRMZs for several resources overlap. For instance, it is common to have areas located within mule deer, greater sage-grouse, sensitive viewshed, and sensitive soil SRMZs. To address overlapping SRMZs, the BLM has divided the PAPA into nine distinct MAs. MA 1 through MA 8 apply to federal lands and minerals. MA 9 applies to all non-federal lands and minerals. The MAs and limits to surface disturbances approved in the PAPA ROD (BLM, 2000b) are discussed in Chapter 2.

Summaries of quantitative effects to SRMZs and other geographically-oriented resources by current levels of development are provided in the appropriate sections of this chapter. This information provides the basis for predicting future impacts associated with each Alternative analyzed in Chapter 4.

Surface disturbance (in acres) due to wellfield activities across the entire PAPA was mapped in December 2005 using QuickBird satellite imagery. Portions of the imagery were updated using additional QuickBird satellite imagery and aerial photography in November 2006.

Before issuance of the PAPA ROD (BLM, 2000b), 8,080.3 acres had been disturbed in the PAPA. Areas of disturbance were primarily concentrated on private lands and were mostly associated with residential areas, recreational facilities, agricultural operations, and the Wenz Field airport. Of this disturbance, 7,639.0 acres is not associated with natural gas development in the PAPA and is not discussed further in this chapter; however, 441.3 acres is associated natural gas development in the PAPA. As of November 2006, there was a total of 4,834.6 acres of natural gas related disturbance in the PAPA. Of this, 441.3 acres were disturbed before issuance of the PAPA ROD and 4,393.3 acres were disturbed subsequent to issuance of the PAPA ROD. These estimates are initial disturbance and do not account for reclamation. Total wellfield related disturbance in the PAPA accounts for 2.4 percent of all lands in the PAPA.

As a result of the proposed increase in natural gas production, the BLM, in consultation with the pipeline companies, has identified three potential corridors for pipelines that would carry hydrocarbon products from the PAPA to processing plants in southwest Wyoming. The pipeline companies have defined two natural gas sales pipelines that would be constructed within the three corridors. Both pipelines would be in one corridor as they leave the PAPA and diverge south of the Bird Canyon Compressor Station. The affected environment for the proposed corridor/pipeline alignments is discussed in this chapter.

3.2 LAND AND MINERAL OWNERSHIP

Federally-managed lands and minerals in the PAPA account for 79.4 percent of lands and minerals while privately owned lands and minerals account for 11.1 percent. Approximately 4.9 percent of all lands in the PAPA are comprised of state-owned lands and minerals while the remaining 4.6 percent of the lands in the PAPA are comprised of mixed surface and mineral ownership (see Map 3.2-1 and Table 3.2-1).

As of November 2006, there were 4,834.6 acres of disturbance in the PAPA (2.4 percent) as a result of wellfield activities (Table 3.2-1). Since issuance of the PAPA ROD, most surface disturbance has been on federal lands and minerals ownership.

Map 3.2-1
Existing Wellfield Disturbance in Relation to Surface and Mineral Ownership

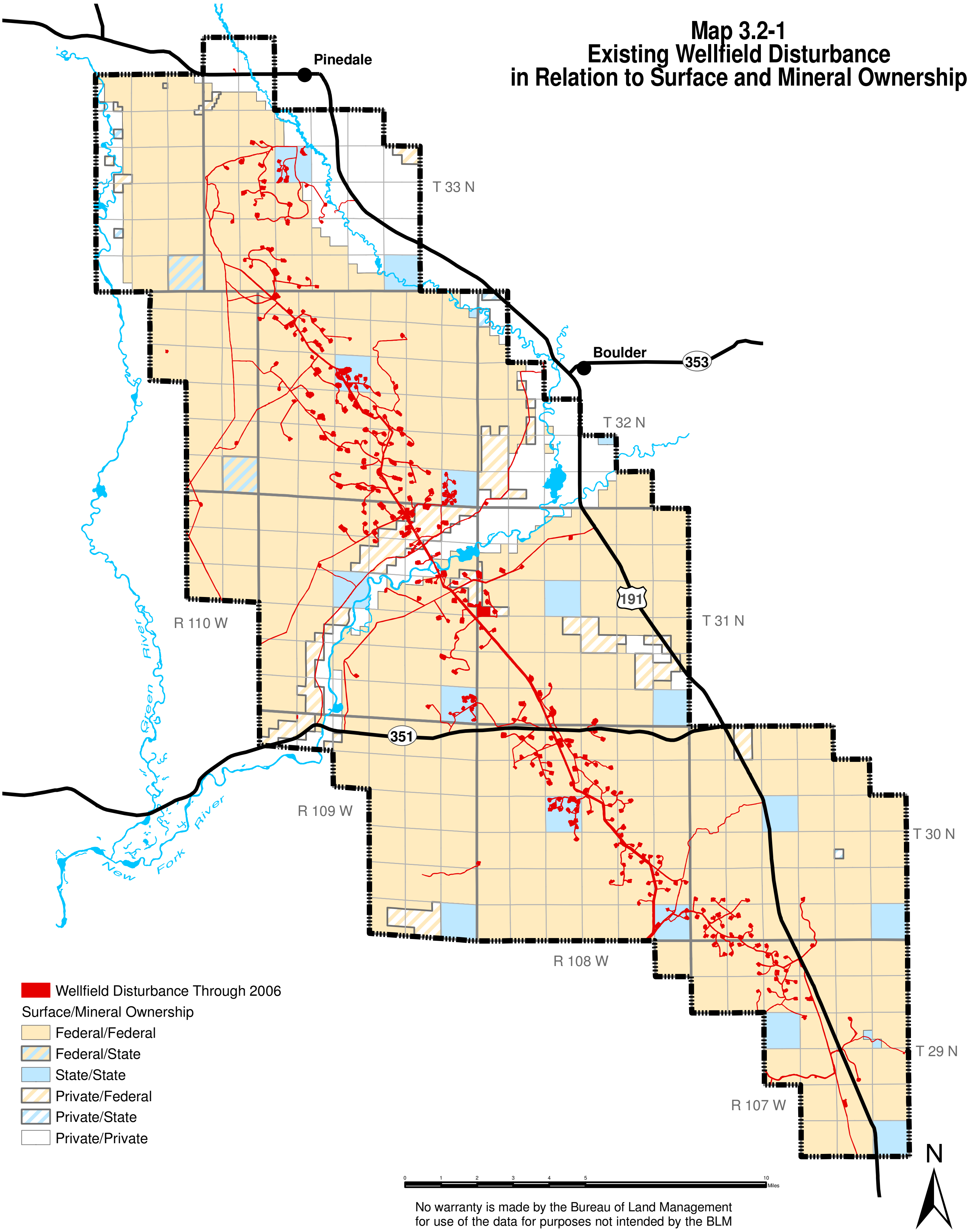


Table 3.2-1
Existing Wellfield Disturbance in Relation to Land and Mineral Ownership

Management/Ownership Category	Total Area in the PAPA (acres)	Percent	Existing Wellfield Disturbance through November 2006 (acres)		
			Federal Lands	Non-Federal Lands	All Lands
Federal Surface/Federal Minerals	157,136	79.4	3,835.1	0.0	3,835.1
Federal Surface/State Minerals	1,279	0.6	0.0	0.0	0.0
State Surface/State Minerals	9,800	4.9	0.0	550.8	550.8
Private Surface/Private Minerals	21,866	11.1	0.0	142.8	142.8
Private Surface/State Minerals	344	0.2	0.0	0.0	0.0
Private Surface/Federal Minerals	7,612	3.8	305.9	0.0	305.9
Total	**198,037**	**100.0**	**4,141.0**	**693.6**	**4,834.6**

3.3 CLIMATE

The climate in the PAPA is semiarid and continental, with short, dry summers and long, cold winters. July and August are the hottest months of the year, while December and January are the coldest. Freezing temperatures can occur anytime of the year (Martner, 1986). According to the National Weather Service (NWS), Pinedale's mean temperature in January is 12.6°F with a mean of 59.8°F in July (Western Regional Climate Center, 2007). High elevation and dry air facilitate thermal radiation gain and loss, as evidenced by Pinedale's wide variation between daily minimum and maximum temperatures (BLM, 1999a).

Annual precipitation (including rain and the water equivalent in snow) in the PAPA averaged 10.6 inches over the 30 water years (a water year extends from October through September) from 1970-1971 through 1999-2000. Snowfall from October through April averages 58 inches in the PAPA (Table 3.3-1).

Table 3.3-1
Estimated Values of Climate Parameters in the PAPA since 2000 Compared to the 30-Year Average from Water Year 1970-1971 through Water Year 1999-2000[1]

Climate Parameter	30-Year Average (1971-2000)	Parameter Values in Water Year					
		2001	2002	2003	2004	2005	2006
Total Precipitation (inches in Water Year)	10.58	5.45	6.26	8.00	11.29	11.78	6.94
Total Snowfall (inches October-April)	57.87	43.54	34.91	49.01	58.89	53.02	42.48
Average Monthly Temperature (°F)	35.84	36.06	35.04	36.82	34.61	36.40	36.30
Average Minimum Monthly Temperature (°F)	19.67	18.62	17.79	20.26	18.63	20.40	18.91
Average Maximum Monthly Temperature (°F)	52.02	53.36	52.28	53.37	50.59	52.40	53.42

[1] Source: Western Regional Climate Center, 2007.

Beginning in 2000 and continuing through 2003, precipitation in the PAPA was consistently below the 30-year average, exhibiting drought conditions. Precipitation during water years 2004 and 2005 was above the 30-year average but below the long-term average in 2006. Total snowfall (October through April) in the PAPA has been below the 30-year average of 58 inches since 1987 (including winter 2006-2007) except during winter 2003-2004. Maximum monthly temperatures, averaged by water year, have generally been above the 30-year average (Table 3.3-1). Average maximum monthly temperature in 2006 was the warmest since 2000.

The region is subject to strong and gusty winds, reflecting channeling and mountain valley flows due to complex terrain. During the winter, strong winds are often accompanied by snow, producing blizzard conditions. The closest comprehensive wind measurements were collected in the Jonah Field Project Area adjacent to the southeast corner of the PAPA at a meteorological station operated by BP from 1999 through 2003. Winds in the PAPA (Table 3.3-2) are from the west to northwest approximately 40 percent of the time.

Table 3.3-2
Wind Direction Frequency Distribution in the Vicinity of the PAPA Averaged from 1999 through 2003[1]

Wind Direction	Frequency (%)
N	5.3
NNE	3.9
NE	3.5
ENE	3.9
E	3.8
ESE	3.3
SE	2.9
SSE	2.8
S	3.8
SSW	4.8
SW	6.0
WSW	6.6
W	9.9
WNW	15.9
NW	14.4
NNW	9.2

[1] Source: BP, 2004.

While the annual mean wind speed is 11.2 miles per hour (mph), wind speeds in excess of 19 mph occur more than 12 percent of the time (Table 3.3-3).

Table 3.3-3
Distribution of Wind Speeds in the Vicinity of the PAPA Averaged from 1999 through 2003[1]

Wind Speed (mph)	Frequency (%)
0 – 4.0	9.1
4.0 – 7.5	25.4
7.5 – 12.1	28.1
12.1 – 19.0	24.7
19.0 – 24.7	7.2
Greater than 24.7	5.5

[1] Source: BP, 2004.

The atmospheric stability class (Table 3.3-4) is a measure of atmospheric turbulence, which directly affects pollutant dispersion. The stability classes are divided into six categories designated “A” (unstable) through “F” (very stable). The “D” (neutral) stability class occurs more than half of the time. The frequency and strength of winds greatly affect the transport and dispersion of air pollutants. Because of the strong winds in the region, the potential for atmospheric dispersion is relatively high, although nighttime cooling enhances stable air and inhibits air pollutant mixing and transport.

Table 3.3-4
Atmospheric Stability Class
Distribution Averaged from 1999 through 2003[1]

Stability Class [2]	Frequency (%)
A	2.4
B	6.1
C	12.2
D	60.2
E	15.4
F	3.7

[1] Source: BP, 2004.
[2] A = unstable; D = neutral; F = very stable

3.4 ENVIRONMENTAL JUSTICE

Federal agencies are required to conduct programs, policies, and activities that substantially affect human health or the environment in a manner that ensures no person is excluded from participation therein, denied the benefit thereof, or subjected to discrimination due to race, color, or national origin. Executive Order 12898 requires federal agencies to assess their projects to ensure that they do not result in disproportionately high or adverse environmental, health, or safety effects to minority or low-income populations.

The minority populations in Lincoln, Sublette, and Sweetwater counties constitute smaller percentages of total population than figures for the United States as a whole (Table 3.4-1). There is a lower percentage of the population below the poverty line in Lincoln, Sublette, and Sweetwater counties than for the State of Wyoming and United States as a whole.

Table 3.4-1
Race and Poverty as a Percentage of Total Population in 2000[1]

State or County	White	Black or African-American	American Indian and Alaska Native	Asian	Native Hawaiian and other Pacific Islander	Some other race	Persons reporting other race or multiple races	Total[2]	Hispanic or Latino origin[3]	Below the poverty line
Lincoln	97.1	0.1	0.6	0.2	0.1	0.7	1.2	100.0	2.2	9.0
Sublette	97.5	0.2	0.5	0.2	0.1	0.5	1.0	100.0	1.9	9.7
Sweetwater	91.6	0.7	1.0	0.6	0.0	3.6	2.4	99.9	9.4	7.8
Wyoming	92.1	0.8	2.3	0.6	0.1	2.5	1.8	100.2	6.4	11.4
U.S.	75.1	12.3	0.9	3.6	0.1	5.5	2.4	99.9	12.5	12.4

[1] Source: U.S. Census Bureau, 2007.
[2] This table uses U.S. Census Bureau statistics which, due to rounding, may total slightly more or less than 100 percent.
[3] People who identify their origin as Hispanic or Latino may be of any race. Thus, the percent Hispanic or Latino should not be added to the race as a percentage of population categories.

3.5 SOCIOECONOMIC RESOURCES

The affected environment for socioeconomic resources includes Sublette, Sweetwater, and Lincoln counties. In this section, the term “Southwest Wyoming” is used to refer to these three counties. The following discussion is for the proposed development in the PAPA and for the proposed corridor/pipeline alignments.

3.5.1 Socioeconomic Trends

Southwest Wyoming is primarily rural with sparse populations that have historically relied on livestock ranching (Rosenberg, 1990; Blevins et al., 2004; and BLM, 2006c). While ranching remains culturally important in Southwest Wyoming, the region's economy has shifted toward mineral extraction (including natural gas production). Sublette County shifted to natural gas drilling about 1920 (Rosenberg, 1990), Lincoln County shifted to coal mining around 1900, and Sweetwater County shifted to trona mining in 1946. Tourism and travel grew as important economic components following World War II (Western, 2002). In Sublette County in 2005, 849 workers were employed in mineral development, 610 in travel/tourism, and 383 in agriculture. The same year in Lincoln County, 664 workers were employed in agriculture, 684 in mineral development, and 590 in travel/tourism. In Sweetwater County, 5,225 workers were employed in mineral development, 1,950 in travel/tourism, and 194 in agriculture in 2005 (U.S. Department of Commerce, 2007 and Dean Runyan Associates, 2006).

The significance of oil and gas revenues to the region's economy has increased and is expected to grow (BLM, 2006c). In 1985, oil and gas interests contributed over 80 percent of tax revenues in Sublette County (Rosenberg, 1990). In 2005, oil and gas production and ancillary facilities accounted for 96 percent of the total assessed valuation for Sublette County, 55 percent for Lincoln County, and 61 percent for Sweetwater County (Wyoming Department of Revenue, 2007). Since 2000, the assessed valuation growth index for Sublette County has increased substantially and has outpaced the statewide average, but Sweetwater County and Lincoln County have trailed the statewide average (Table 3.5-1). Per-capita assessed valuation revenues from oil and gas production facilities are substantially higher for Sublette County than for neighboring counties or for Wyoming (Table 3.5-2).

Table 3.5-1
Total Assessed Valuation and Assessed Valuation Indices, Southwest Wyoming from 2000 to 2006[1]

Year	Lincoln County (millions)	Sublette County (millions)	Sweetwater County (millions)	Wyoming (billions)	Lincoln County Index	Sublette County Index	Sweetwater County Index	Wyoming Index
2000	$437.8	$475.8	$1,126.3	$7.9	100.0	100.0	100.0	100.0
2001	$574.1	$851.3	$1,407.0	$10.5	131.1	178.9	124.9	133.5
2002	$591.7	$1,097.1	$1,404.3	$11.2	135.1	230.6	124.7	141.4
2003	$448.0	$934.7	$1,160.7	$10.3	102.3	196.4	103.1	130.9
2004	$597.5	$2,039.1	$1,563.3	$13.7	136.5	428.5	138.8	173.2
2005	$753.1	$2,924.0	$1,821.9	$16.4	172.0	614.5	161.8	208.2
2006	$943.6	$4,401.6	$2,380.6	$21.0	215.5	925.0	211.4	265.7

[1] Source: Wyoming Department of Revenue, 2007.

Table 3.5-2
Per-Capita Assessed Valuation from Oil and Gas Production Facilities, Southwest Wyoming from 2000 to 2006[1]

Year	Lincoln County Per-Capita	Sublette County Per-Capita	Sweetwater County Per-Capita	State of Wyoming Per-Capita
2000	$30,042	$80,378	$29,944	$15,993
2001	$38,957	$143,389	$38,268	$21,338
2002	$39,604	$176,362	$37,654	$22,381
2003	$29,380	$147,008	$31,289	$20,601
2004	$38,130	$306,452	$41,612	$27,041
2005	$47,074	$422,177	$47,976	$32,290
2006	$70,509	$598,127	$61,415	$40,735

[1] Source: Wyoming Department of Revenue, 2007.

In 2006, per-capita sales tax collections were $1,403 in Lincoln County, $6,514 in Sublette County, and $2,049 in Sweetwater County. In 2006, statewide per-capita sales tax collections averaged $1,396 (WDAI, 2007a).

Oil and gas exploration and drilling operations in Southwest Wyoming have been cyclical in nature. During the 1970s, employment in the oil and gas sector grew steadily as drilling activity increased in southern Sublette County. Employment spiked in the early 1980s when natural gas processing plants were built in Southwest Wyoming but employment dropped in the mid-1980s. There was gradual job growth in the oil and gas sector in Southwest Wyoming during the 1990s with increased exploration and development of the Jonah Field Project Area and the PAPA.

Since 1999, job growth associated with oil and gas development has increased at an accelerating rate. Average annual earnings per development job and average earnings per production job are higher than wages paid in other employment sectors (Table 3.5-3). Employment related to natural gas development in the PAPA constituted an increasing component of total regional employment from 2000-2006 (Table 3.5-4). In a 1997 survey, the University of Wyoming reported that residents believed oil and gas would be more important than hospitality or agriculture industries in Sublette County within the next 10 years (McLeod et al., 1997). Sublette County residents have recently expressed strong opinions on the issues associated with changes and growth accompanying oil and gas exploration and drilling.

Increased tax revenues from oil and gas development in the PAPA have supported infrastructure investments in Sublette County. Recent community projects in Sublette County include expansion of the county library, extension and renovation of the courthouse, remodeling in School District Number 1, a new riding arena, baseball fields, a skateboard park (Blevins et al., 2004), a new jail, landfill, senior center, and a public clinic upgrade (BLM, 2006e). The county is making plans to build a $17.2 million aquatic center, which includes a three-story climbing wall, two racquetball courts, and a competition-sized swimming pool (Gruver, 2006). Some residents fear that the likelihood of a future lag in oil and gas exploration makes it imprudent to continue to increase infrastructure investments in the county. For example, in the early 1980s, the second phase of a drilling project failed to occur and the county had already constructed a high school with 50 percent surplus capacity. Accordingly, local residents are engaged in an ongoing debate concerning the appropriate scope and pace for oil and gas development in Sublette County, and the appropriate level of infrastructure investments to support growth and development.

Table 3.5-3
Employment and Earnings Associated with Natural Gas Development from 2000 to 2006 (2003$)[1,2]

PAPA Related Data	2000	2001	2002	2003	2004	2005	2006
Resource Development Phase:							
Wells Drilled [1]	2	39	58	75	119	117	185
Total Employment per Well	47.4	47.4	47.4	47.4	47.4	47.4	47.4
Local Employment per Well	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Total Development Employment	95	1,848	2,748	3,554	5,638	5,543	8,765
Local Development Employment	49	959	1,427	1,845	2,927	2,878	4,551

PAPA Related Data	2000	2001	2002	2003	2004	2005	2006
Total Earnings per Well	$2,430,179	$2,430,179	$2,430,179	$2,430,179	$2,430,179	$2,430,179	$2,430,179
Local Earnings per Well	$1,117,657	$1,117,657	$1,117,657	$1,117,657	$1,117,657	$1,117,657	$1,117,657
Total Development Earnings	$4,860,357	$94,776,965	$140,950,359	$182,263,395	$289,191,253	$284,330,896	$449,583,041
Local Development Earnings	$2,235,314	$43,588,623	$64,824,106	$83,824,275	$133,001,183	$130,765,869	$206,766,545
Average Earning per Job-Total	$51,291	$51,291	$51,291	$51,291	$51,291	$51,291	$51,291
Average Earning per Job-Local	$45,433	$45,433	$45,433	$45,433	$45,433	$45,433	$45,433
Resource Production Phase:							
Natural Gas Production (MMSCF)	10,587	21,702	61,747	109,864	180,399	237,910	284,790
Condensate Production (MBO)	100	210	551	882	1,425	1,869	2,202
Employment per MMSCF	0.002008	0.002008	0.002008	0.002008	0.002008	0.002008	0.002008
Employment per MBO	0.013388	0.013388	0.013388	0.013388	0.013388	0.013388	0.013388
Total Production Employment	23	46	131	232	381	503	601
Earnings per MMSCF	$104.90	$104.90	$104.90	$104.90	$104.90	$104.90	$104.90
Earnings per MBO	$699.42	$699.42	$699.42	$699.42	$699.42	$699.42	$699.42
Total Production Earnings	$1,180,549	$2,423,482	$6,862,822	$12,141,945	$19,921,059	$26,264,674	$31,415,431
Average earnings per production job	$52,243	$52,243	$52,243	$52,243	$52,243	$52,243	$52,243

[1] WOGCC, 2007.
[2] Assumes all wells drilled are completed.

Table 3.5-4
PAPA Contribution to Total Regional Employment from 2000 to 2006[1]

Region	2000	2001	2002	2003	2004	2005	2006[2]
Lincoln County	8,114	8,434	8,751	9,195	9,270	9,302	10,060
Sublette County	3,977	4,251	4,548	4,818	5,133	5,703	6,760
Sweetwater County	24,249	24,493	23,989	24,849	26,030	27,628	30,196
Total Tri-County Employment	36,340	37,178	37,288	38,862	40,433	42,633	47,016
Percent employed in the PAPA-Total	0.3	5.1	7.7	9.7	14.9	14.2	19.9
Percent employed in the PAPA-Local	0.2	2.7	4.2	5.3	8.2	7.9	11.0

[1] Source: U.S. Department of Commerce, 2007.
[2] Source: U.S. Department of Labor, 2007.

Production from the PAPA represents 13.6 percent of Wyoming's natural gas production. The PAPA is the third largest oil and gas production field in Wyoming (WOGCC, 2007). The Pinedale Anticline ranks second of the top 100 U.S. fields according to proven gas reserves from estimated 2005 field level data and fourth in gas production (Energy Information Administration, 2007). Southwest Wyoming produces 22.9 percent of the oil produced in Wyoming and 60.1 percent of the natural gas produced in the state (Table 3.5-5).

Table 3.5-5
Oil and Gas Production in Southwest Wyoming, 2006[1]

County	Producing Wells	Oil (Bbls)	Percent of Wyoming's Oil Total	Natural Gas (MSCF)	Percent of Wyoming's Gas Total
Lincoln	1,309	778,037	1.51	85,705,325	4.28
Sublette	3,035	5,753,809	11.14	879,285,436	43.93
Sweetwater	2,898	5,295,805	10.26	238,004,077	11.89
Total	**7,242**	**11,827,651**	**22.91**	**1,202,994,838**	**60.10**

[1] Source: WOGCC, 2007.

3.5.2 Population

The population of Southwest Wyoming is growing (Table 3.5-6). According to the U.S. Census Bureau (2007), between 2000 and 2006, Sublette County grew an estimated 24.3 percent (1,439 people); Lincoln County grew an estimated 12.4 percent (1,810 people); and Sweetwater County grew 3.1 percent (1,150 people), compared with 4.3 percent growth for Wyoming as a whole. These census statistics underestimate the rate of growth in Southwest Wyoming because the statistics do not account for the increasing number of transient workers who consider residences outside the counties their primary homes (Blevins et al., 2004). Furthermore, these data neither reflect growth that occurred in 2007, nor forecast the impacts of increased drilling activity.

Table 3.5-6
Population Estimates in Southwest Wyoming from 2000 to 2006[1]

Location	2000	2006[2]	Percent Change 2000-2006
Lincoln County	14,573	16,383	12.4
Afton	1,818	1,821	0.1
Kemmerer	2,651	2,525	-4.8
LaBarge	431	440	2.1
Opal	102	97	-4.9
Sublette County	5,920	7,359	24.3
Big Piney	408	461	13.0
Bondurant	155	NA	0.0
Boulder	30	NA	0.0
Cora	76	NA	0.0
Daniel	89	NA	0.0
Marbleton	720	862	19.7
Pinedale	1,412	1,846	30.7
Sweetwater County	37,613	38,763	3.1
Eden	388	NA	0.0
Farson	242	NA	0.0
Green River	11,808	11,933	1.1
Rock Springs	18,708	19,324	3.3
Wyoming	493,782	515,004	4.3

[1] Source: U.S. Census Bureau, 2007.
[2] NA = not available.

Between 2000 and 2006, 71 percent of Lincoln County's growth and 91 percent of Sublette County's growth was from immigration rather than natural increase, contrasted with 33 percent immigration for Wyoming as a whole. Sweetwater County experienced an estimated net emigration of 597 people during this time, and its population growth was attributed to natural increase, births exceeding deaths (WDAI, 2007b).

Southwest Wyoming's population is expected to continue growing for the next several years. The Wyoming Department of Administration and Information (WDAI) forecast population trends for Wyoming counties that incorporate long-term trends in commodity prices and mineral development. The WDAI's population forecasts for Southwest Wyoming, a moderate growth scenario, are shown in Table 3.5-7 (WDAI, 2007b).

Table 3.5-7
Population Forecasts for Southwest Wyoming, 2007 to 2020[1]

Location	2007 Forecast	2010 Forecast	2015 Forecast	2020 Forecast
Lincoln County	**16,800**	**17,990**	**19,480**	**21,070**
Afton	1,988	2,129	2,305	2,493
Alpine	787	842	912	987
Cokeville	539	577	625	676
Diamondville	763	817	885	957
Kemmerer	2,802	3,001	3,250	3,515
La Barge	459	492	532	576
Opal	109	116	126	136
Thayne	376	403	436	472
Sublette County	**7,690**	**8,870**	**10,460**	**12,320**
Big Piney	517	596	703	828
Marbleton	917	1,057	1,247	1,469
Pinedale	1,813	2,092	2,467	2,905
Sweetwater County	**39,540**	**41,620**	**42,810**	**43,990**
Bairoil	101	106	109	112
Granger	153	161	166	170
Green River	12,336	12,985	13,356	13,725
Rock Springs	19,595	20,626	21,216	21,801
Superior	252	266	273	281
Wamsutter	277	291	300	308
County Totals	**64,030**	**68,480**	**72,750**	**77,380**

[1] Source: WDAI, 2007b.

3.5.3 Employment and Income Levels

The labor force and employment levels are growing in Southwest Wyoming (see Table 3.5-8). The labor force is growing most rapidly in Sublette County, with a 59.4 percent increase from 2000 to 2006. Recent unemployment data for Southwest Wyoming are mixed. In Sublette County, the unemployment rate has dropped 37.9 percent and has lower unemployment rates than the State of Wyoming, while statewide unemployment levels were among the lowest in the country from 2000 to 2006 (Table 3.5-8). Lincoln County has had unemployment rates higher than Wyoming's rate, but lower than the U.S. rate, since 2000. Sweetwater County's rate has been lower than the U.S. since 2001, and lower than Wyoming's rate since 2003.

Table 3.5-8
Labor Market Information for Southwest Wyoming, 2000 to 2006[1]

	2000	2001	2002	2003	2004	2005	2006	Percent change, 2000-2006
Lincoln County:								
Labor Force	7,357	7,563	7,493	8,324	8,011	7,847	8,191	11.3
Unemployment	285	303	351	381	322	327	288	1.1
Unemployment Rate	3.9	4.0	4.7	4.6	4.0	4.2	3.5	-10.3
Sublette County:								
Labor Force	3,560	3,756	3,881	4,133	4,485	4.998	5,674	59.4
Unemployment	105	100	114	130	109	106	100	-4.8
Unemployment Rate	2.9	2.7	2.9	3.1	2.4	2.1	1.8	-37.9
Sweetwater County								
Labor Force	20,716	20,892	20,184	20,829	21,297	22,106	23,596	13.9
Unemployment	819	828	848	858	712	663	588	-28.2
Unemployment Rate	4.0	4.0	4.2	4.1	3.3	3.0	2.5	-37.5
Wyoming:								
Unemployment Rate	3.8	3.9	4.2	4.5	3.9	3.7	3.2	-15.8
United States:								
Unemployment Rate	4.0	4.7	5.8	6.0	5.5	5.1	4.6	15.0
[1] Source: Wyoming Department of Employment, 2007.								

In 2005, the average wages per job in Sublette and Sweetwater counties exceeded the Wyoming average (Table 3.5-9). For the period 2000 to 2005, average wages per job increased 23.9 percent in Lincoln County, 49.0 percent in Sublette County, and 23.8 percent in Sweetwater County, compared with a 24.3 percent increase for Wyoming.

Table 3.5-9
Average Wages per Job for Southwest Wyoming, 1990 to 2005[1]

	1990	1999	2000	2001	2002	2003	2004	2005
Lincoln County	$20,150	$24,456	$25,072	$25,931	$27,618	$30,117	$30,474	$31,071
Sublette County	$17,628	$22,310	$24,697	$25,479	$27,756	$30,063	$31,896	$36,807
Sweetwater County	$25,629	$32,648	$33,839	$35,654	$36,193	$37,399	$38,710	$41,907
Wyoming	$19,844	$25,561	$26,602	$27,810	$28,838	$29,797	$31,219	$33,069
[1] Source: U.S. Department of Commerce, 2007.								

Some residents of Southwest Wyoming, including retirees who have moved to the area, have notable levels of unearned income (dividends, interest, and rent). Figure 3.5-1 shows that there was a slight decline in unearned income levels in Southwest Wyoming between 1999 and 2004. This is most likely due to contractions in the national economy and stock market adjustments that occurred in the early 2000s. This trend is most pronounced in Sweetwater and Lincoln counties. In 2005, the Dividends, Interest, and Rent reported for Southwest Wyoming were $387 million or 17.6 percent of total personal income (U.S. Department of Commerce, 2007).

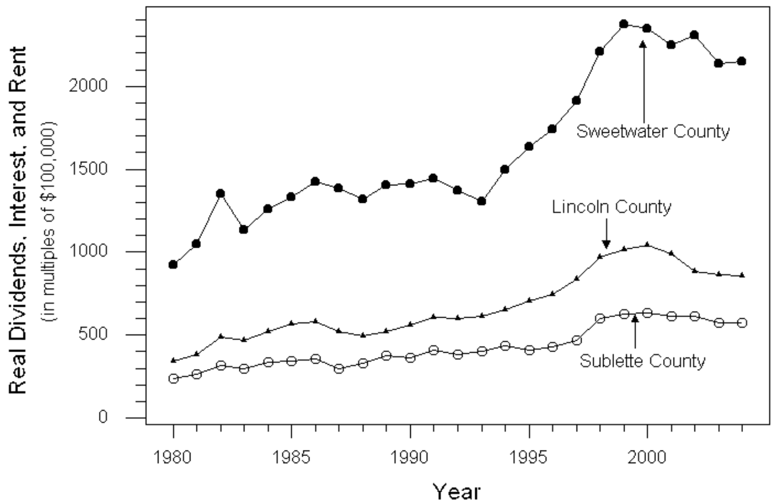


Figure 3.5-1
Real Dividends, Interest, and Rent in Southwest Wyoming between 1980 and 2004
(Source: U.S. Dept. of Commerce, 2007)

Per-capita income is estimated by dividing the aggregate income of a geographic area by the area's total population. It includes wages, interests and dividends from estates and trusts, and transfer payments (e.g. social security, public assistance, and disability pensions). In Sublette County, per-capita income grew by 52 percent between 2000 and 2005, compared to 24 percent for Lincoln County, 30 percent for Sweetwater County, and 31 percent for Wyoming (Table 3.5-10).

Table 3.5-10
A Comparison of Per-Capita Income
Statistics for Southwest Wyoming from 2000 to 2005[1]

	2000	2001	2002	2003	2004	2005
Lincoln	$23,059	$24,773	$24,894	$27,410	$28,078	$28,632
Sublette	$27,678	$30,563	$31,458	$35,040	$38,481	$42,181
Sweetwater	$29,498	$30,474	$30,822	$33,160	$34,166	$38,039
Wyoming	$28,458	$30,304	$30,990	$32,742	$35,058	$37,305
[1] Source: U.S. Department of Commerce, 2007.						

3.5.4 Cost of Living

In recent years, residents of Southwest Wyoming have experienced increases in the cost-of-living above the national average. Table 3.5-11 and Figure 3.5-2 show that the inflation rate in Southwest Wyoming has exceeded the average statewide and national inflation rates since 2004.

Table 3.5-11
Annual Inflation Rates[1]

Quarter	United States (percent)	Wyoming (percent)	Southwest Wyoming (percent)
2nd Qtr 2001	3.2	4.3	3.1
4th Qtr 2001	1.6	3.5	2.3
2nd Qtr 2002	1.1	2.5	1.4
4th Qtr 2002	2.4	3.7	2.5
2nd Qtr 2003	2.1	2.9	3.5
4th Qtr 2003	1.9	3.6	4.3
2nd Qtr 2004	3.3	4.9	4.6
4th Qtr 2004	3.3	4.3	4.8
2nd Qtr 2005	2.5	4.5	6.6
4th Qtr 2005	3.4	5.0	8.3
2nd Qtr 2006	4.3	5.6	7.6
4th Qtr 2006	2.5	4.4	4.8
2nd Qtr 2007	2.7	4.7	6.2

[1] Source: WDAI, 2007c.

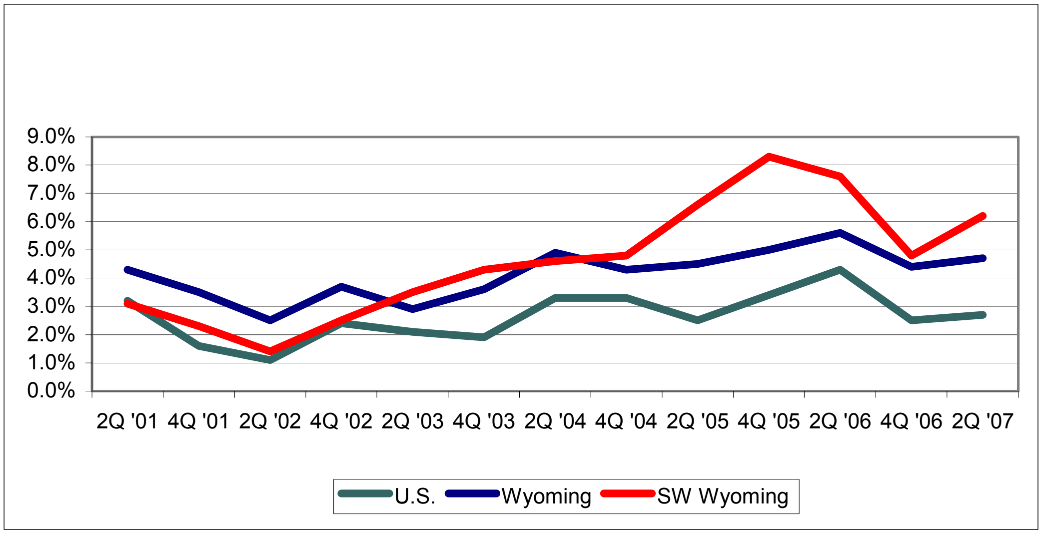


Figure 3.5-2
Annual Inflation Rates for Unites States, Wyoming, and Southwest Wyoming
(Source: WDAI, 2007c)

Sublette County currently has the highest cost of living in Southwest Wyoming (Table 3.5.12). In particular, the cost of housing, which accounts for nearly half of the WDAI's cost-of-living index, is highest in Sublette County. The cost of housing in Sublette County was 27 percent above the statewide average in the fourth quarter of 2006, and 24 percent higher in the second quarter of 2007.

Table 3.5-12
A Comparison of Cost of Living Index Statistics for Southwest Wyoming and the State of Wyoming in the Fourth Quarter, 2006, and Second Quarter 2007[1]

County	All Items	Food	Housing	Apparel	Transportation	Medical	Recreation & Personal Care
Lincoln (Kemmerer)							
4th Qtr 2006	92	85	88	100	102	85	109
2nd Qtr 2007	93	88	88	106	100	84	107
Sublette							
4th Qtr 2006	117	106	127	125	101	105	115
2nd Qtr 2007	114	104	124	125	101	97	109
Sweetwater							
4th Qtr 2006	107	97	117	92	100	104	96
2nd Qtr 2007	108	96	118	93	101	103	97
Wyoming State Average	100	100	100	100	100	100	100

[1] Source: WDAI, 2007c.

Figure 3.5-3 compares the increase in nominal and real average wages in Sublette County and shows that the county's increased cost of living has dampened the real gains from rising wage levels. Although real wages have increased since 2000, they have not increased as much as average annual wage increases would suggest.

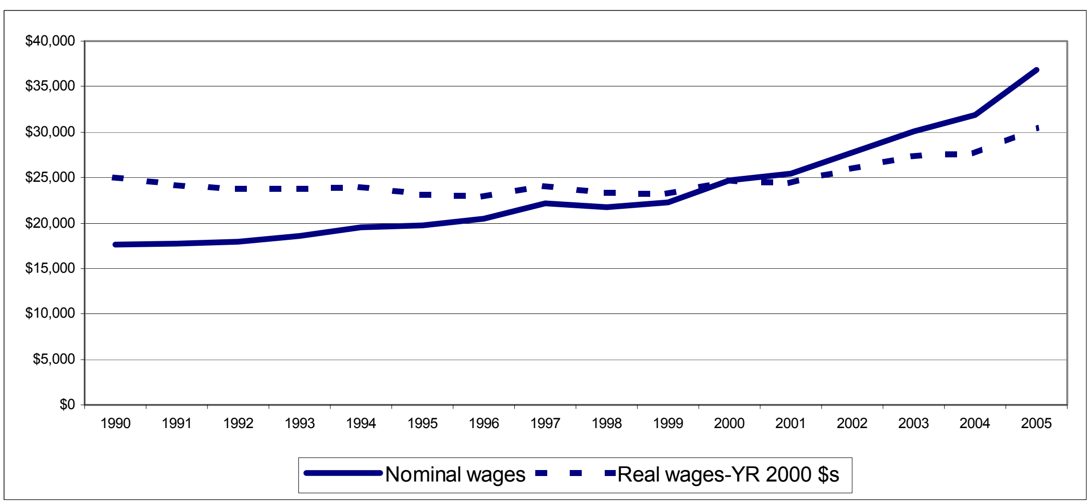


Figure 3.5-3
Nominal and Real Average Wages per Job in Sublette County, 1990-2005 (real wages in Year 2000 $s)

3.5.5 Growth in Economic Sectors

The largest industry in Southwest Wyoming is mining, which contributed 32.3 percent to the region's total industry earnings in 2005, according to the U.S. Department of Commerce's North American Industry Classification System (NAICS).

From 2001 to 2005, the mining sector in Lincoln County was the fastest growing employer, growing at 56.9 percent. The industry with the fastest growing earnings was "Real Estate and Rental and Leasing" (109.5 percent growth), followed by "Mining" (100 percent growth).

The "Mining" category includes oil and gas development and production. In 2005, due to federal and state protocols regarding disclosure restrictions (which apply to all non-disclosures reported herein), data for two of the three subcategories under "Mining" were not released for Lincoln County. In 2004, however, "Oil and Gas Extraction" contributed $24.2 million or 42.6 percent, to the mining category; mining (other than oil and gas) contributed $22.1 million, or 39 percent; and "Support Activities for Mining" contributed $10.4 million, or 18 percent in Lincoln County. Coal mining predominates in Lincoln County; the Pittsburg and Midway Coal Mining Company employs 297 workers (City of Kemmerer, 2007).

Sublette County's economy as a whole grew faster than the economies of Sweetwater and Lincoln counties, with total industry earnings in the county growing by 98.8 percent in a 4-year period (Table 3.5-13). From 2001 to 2005, the mining sector was the fastest growing employer in Sublette County, increasing by 96.5 percent. The largest sectoral employer in Sublette County in 2005 was "Mining" (849), followed by "Government and Government Enterprises" (840), and then by "Construction" (814). The industry with the fastest growing earnings was "Agriculture" (246.1 percent growth), followed by "Mining" (186.6 percent growth), and "Construction" (154.3 percent growth). Even though the growth rate of earnings in agriculture led all others, employment in that sector decreased from 2001 to 2005 and the sector "Mining" had earnings 8.7 times larger than "Agriculture." In terms of total earnings, the value of the mining sector (over $65.4 million) made it the largest industry in the county in 2005, comprising 31 percent of the county's industry earnings (Table 3.5-13). In 2001, the category "Mining" (worth $22.8 million), was divided between the subcategories "Oil and Gas Extraction" ($12.4 million) and "Support Activities for Mining" ($10.4 million). There was no mining activity other than oil and gas extraction for Sublette County. In 2005, the exact amount contributed to the category "Mining" by "Oil and Gas Extraction" was not reported; however, $35.9 million was reported as "Support Activities for Mining" (55 percent of the total reported for the category "Mining").

Sweetwater County had industry earnings from "Mining" of $475 million in 2005, 35.3 percent of the county's industry earnings. The category "Oil and Gas Extraction" constituted 17.6 percent of mining earnings, "Mining (except oil and gas)" constituted 42.2 percent, and "Support Services for Mining" constituted 40.2 percent. "Mining (except oil and gas)" is mostly trona mining with some coal mining in Sweetwater County. The subcategory "Support Activities for Mining" earned $191 million in 2005, up 97.8 percent from 2001. Among reported industry earnings, the fastest growing category between 2001 and 2005 was "Educational Services" at 100.1 percent, followed by "Construction" (53.1 percent) and "Transportation and Warehousing" (45.7 percent). The fastest growing employer was "Education Services" (48.4 percent).

Table 3.5-13
Changes in Employment and Industry Earnings
in Southwest Wyoming from 2001 to 2005 by NAICS Category[1,2]

NAICS Sector	County	Employment			Industry Earnings		
		2001	2005	Percent Change 2001-2005	2001 (thousands)	2005 (thousands)	Percent Change 2001-2005
Agriculture	Lincoln	675	664	-1.6	$3,204	$5,640	76.0
	Sublette	396	383	-3.3	$2,165	$7,493	246.1
	Sweetwater	198	194	-2.0	$703	$171	-75.7
Agricultural services	Lincoln	87	89	2.3	$1,157	$1,329	14.9
	Sublette	78	90	15.4	$788	$1,032	31.0
	Sweetwater	ND	46	-	ND	553	-
Mining	Lincoln	436	684	56.9	$29,898	$59,861	100.0
	Sublette	432	849	96.5	$22,820	$65,413	186.6
	Sweetwater	ND	5,225	-	ND	$475,405	-
Utilities	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	30	-	ND	$2,252	-
	Sweetwater	ND	ND	-	ND	ND	-
Construction	Lincoln	1,227	1,225	-0.1	$41,152	$43,350	5.3
	Sublette	472	814	72.5	$13,868	$35,269	154.3
	Sweetwater	1,811	2,257	24.6	$72,985	$111,710	53.1
Manufacturing	Lincoln	403	351	-12.9	$12,879	$10,466	-18.7
	Sublette	ND	92	-	ND	$2,712	-
	Sweetwater	1,426	1,236	-13.3	$110,430	$114,005	3.2
Wholesale trade	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	22	-	ND	$639	-
	Sweetwater	ND	ND	-	ND	ND	-
Retail trade	Lincoln	1,009	1,020	1.1	$14,026	$16,424	17.1
	Sublette	442	506	14.5	$8,455	$10,731	26.9
	Sweetwater	2,928	3,106	6.1	$56,203	$70,920	26.2
Transportation and warehousing	Lincoln	220	245	11.4	$10,030	$10,343	3.1
	Sublette	81	135	66.7	$2,982	$4,959	66.3
	Sweetwater	1,111	1,479	33.1	$56,599	$82,438	45.7
Information	Lincoln	125	165	32.0	$3,387	$5,077	49.9
	Sublette	51	73	43.1	$1,132	$1,921	69.7
	Sweetwater	258	261	1.2	$6,334	$7,400	16.8
Finance and insurance	Lincoln	224	258	15.2	$7,237	$5,743	-20.6
	Sublette	81	122	50.6	$2,204	$4,354	97.5
	Sweetwater	540	565	4.6	$16,917	$20,355	20.3
Real estate and rental and leasing	Lincoln	324	384	18.5	$4,545	$9,521	109.5
	Sublette	175	197	12.6	$2,378	$4,373	83.9
	Sweetwater	675	867	28.4	$27,910	$35,189	26.1

NAICS Sector	County	Employment 2001	Employment 2005	Employment Percent Change 2001-2005	Industry Earnings 2001 (thousands)	Industry Earnings 2005 (thousands)	Industry Earnings Percent Change 2001-2005
Professional and technical services	Lincoln	231	303	31.2	$5,353	$8,397	56.9
	Sublette	237	278	17.3	$8,715	$13,269	52.3
	Sweetwater	616	727	18.0	$24,655	$33,925	37.6
Management of companies and enterprises	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	90	97	7.8	$4,613	$4,578	-0.8
Administrative and waste services	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	799	920	15.1	$15,731	$22,415	42.5
Educational services	Lincoln	21	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	91	135	48.4	$769	$1,539	100.1
Health care and social assistance	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	1,196	1,273	6.4	$32,770	$41,002	25.1
Arts, entertainment, and recreation	Lincoln	124	131	5.6	$2,607	$3,169	21.6
	Sublette	95	106	11.6	$2,379	$3,097	30.2
	Sweetwater	284	ND	-	$3,453	ND	-
Accommodations and food services	Lincoln	585	615	5.1	$5,227	$5,342	2.2
	Sublette	386	512	32.6	$5,051	$9,339	84.9
	Sweetwater	2,102	2,327	10.7	$27,564	$37,290	35.3
Other services, except public administration	Lincoln	376	453	20.5	$4,702	$5,590	18.9
	Sublette	211	277	31.3	$2,434	$3,079	26.5
	Sweetwater	1,062	1,216	14.5	$19,683	$24,591	24.9
Government and government enterprises	Lincoln	1,556	1,703	9.4	$49,088	$69,208	41.0
	Sublette	702	840	19.7	$24,248	$39,001	60.8
	Sweetwater	4,210	4,242	0.8	$145,276	$179,556	23.6
TOTAL	**Lincoln**	**8,434**	**9,302**	**10.3**	**$221,637**	**$298,268**	**34.6**
	Sublette	**4,251**	**5,703**	**34.2**	**$108,944**	**$216,582**	**98.8**
	Sweetwater	**24,493**	**27,628**	**12.8**	**$984,951**	**$1,346,522**	**36.7**

[1] Source: U.S. Department of Commerce, 2007.
[2] Note: All data include self-employed workers, ND = non-disclosure.
[3] NAICS data are only available for 2001-2005.

3.5.6 Housing

The U.S. Census Bureau estimates that between 2000 and 2006, the number of housing units increased by 17.6 percent in Lincoln County, 15.9 percent in Sublette County, and 3.5 percent in Sweetwater County. In 2000, homes for seasonal, occasional, or recreational use accounted for 26.2 percent of the housing units in Sublette County, 13.4 percent of the housing units in Lincoln County, and 1.5 percent of the housing units in Sweetwater County (Table 3.5-14).

Recent studies of housing affordability suggest that it may be prohibitively expensive for wage earners, including workers employed in the PAPA, to move to Southwest Wyoming (Sublette SE, 2007). Between 2000 and 2007, the cost of renting an apartment increased 90 percent in Lincoln County, 90 percent in Sublette County, and 93 percent in Sweetwater County (Table 3.5-15). During this same period, the cost of renting a house increased 16 percent in Lincoln County, 114 percent in Sublette County, and 109 percent in Sweetwater County (Table 3.5-15). The cost of renting a mobile home lot increased 36 percent in Lincoln County, 57 percent in Sublette County, and 33 percent in Sweetwater County. The cost of renting a mobile home on a lot increased 77 percent in Lincoln County, 53 percent in Sublette County, and 90 percent in Sweetwater County.

Table 3.5-14
Housing Unit Estimates in Southwest Wyoming and Wyoming from 2000 and 2006[1]

	Lincoln County		Sublette County		Sweetwater County		Wyoming	
Value	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000
2000	6,831	N/A	3,552	N/A	15,921	N/A	223,854	N/A
2001	7,014	2.68	3,620	1.91	15,995	0.46	225,959	0.94
2002	7,224	5.75	3,693	3.97	16,026	0.66	227,772	1.75
2003	7,417	8.57	3,773	6.22	16,045	0.78	229,638	2.58
2004	7,591	11.12	3,859	8.64	16,078	0.99	232,560	3.89
2005	7,788	14.01	3,944	11.04	16,254	2.09	235,657	5.27
2006	8,030	17.55	4,118	15.93	16,484	3.54	239,178	6.85

[1] Source: U.S. Census Bureau, 2007.

Table 3.5-15
Average Rental Housing Costs in Southwest Wyoming from 2000 to 2006[1]

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
2nd Quarter, 2000	Lincoln	$245	$466	$158	$311
	Sublette	$433	$624	$175	$435
	Sweetwater	$367	$485	$196	$389
4th Quarter, 2000	Lincoln	$277	$417	$195	$317
	Sublette	$464	$566	$165	$325
	Sweetwater	$333	$498	$196	$401
2nd Quarter, 2001	Lincoln	$295	$464	$175	$330
	Sublette	$455	$608	$165	NR
	Sweetwater	$368	$534	$200	$439
4th Quarter, 2001	Lincoln	$292	$400	$158	$315
	Sublette	$441	$613	$175	$350
	Sweetwater	$390	$533	$201	$422
2nd Quarter, 2002	Lincoln	$285	$441	$163	$328
	Sublette	$472	$611	$200	NR
	Sweetwater	$387	$518	$202	$443
4th Quarter, 2002	Lincoln	$332	$388	$163	$304
	Sublette	$534	$655	$165	$457
	Sweetwater	$392	$516	$197	$422

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
2nd Quarter, 2003	Lincoln	$414	$534	$157	$403
	Sublette	$520	$769	$200	$472
	Sweetwater	$391	$539	$208	$449
4th Quarter, 2003	Lincoln	$421	$433	$183	$315
	Sublette	$611	$794	$200	NR
	Sweetwater	$412	$595	$218	$457
2nd Quarter, 2004	Lincoln	$347	$382	$163	$300
	Sublette	$647	$808	$225	$624
	Sweetwater	$427	$635	$212	$566
4th Quarter, 2004	Lincoln	$364	$387	$168	$312
	Sublette	$765	$888	$240	$600
	Sweetwater	$469	$654	$212	$546
2nd Quarter, 2005	Lincoln	$379	$407	$178	$374
	Sublette	$699	$882	$240	$590
	Sweetwater	$512	$674	$214	$594
4th Quarter, 2005	Lincoln	$391	$402	$178	$390
	Sublette	$728	$1,083	$275	$595
	Sweetwater	$624	$773	$224	$619
2nd Quarter, 2006	Lincoln	$431	$484	$178	$406
	Sublette	$781	$1,195	$265	$643
	Sweetwater	$684	$816	$238	$669
4th Quarter, 2006	Lincoln	$428	$510	$220	$515
	Sublette	$750	$1,238	$275	$693
	Sweetwater	$686	$922	$253	$701
2nd Quarter, 2007	Lincoln	$466	$540	$215	$550
	Sublette	$822	$1,338	$275	$667
	Sweetwater	$709	$1,013	$261	$741
[1] Source: WDAI, 2007c.					

The Wyoming Rental Vacancy Survey is administered and analyzed semiannually by the Wyoming Housing Database Partnership (Table 3.5-16). Vacancy rates are extrapolated based on a sampled population each June or July (denoted ‘a’) and December (denoted ‘b’). Second home growth can be attributed to some vacant units, especially in Sublette County (U.S. Census Bureau, 2007). According to the 2000 Census, in Sublette County 930 of 1,181 vacant housing units were vacant for seasonal, recreational, or occasional use (U.S. Census Bureau, 2007).

Table 3.5-16
Semiannual (Year with a and b) Rental Vacancy Survey for Southwest Wyoming from 2001 to 2007[1]

Year	County	Sample	Total Units	Vacant Units	Percent Vacancy Rate
2001a	Lincoln	13	287	26	9.0
	Sublette	4	41	2	4.9
	Sweetwater	16	821	67	8.2
2001b	Lincoln	9	132	19	14.4
	Sublette	2	39	NR[2]	NR[2]
	Sweetwater	19	1,083	49	4.5
2002a	Lincoln	8	114	10	8.8
	Sublette	3	41	NR[2]	NR[2]
	Sweetwater	20	1,060	65	6.1
2002b	Lincoln	7	151	22	14.6
	Sublette	5	37	2	5.4
	Sweetwater	21	1,439	65	4.5
2003a	Lincoln	7	106	7	6.6
	Sublette	7	50	2	4.0
	Sweetwater	24	1,620	34	2.1
2003b	Lincoln	11	201	11	5.5
	Sublette	6	55	2	3.6
	Sweetwater	33	1,942	18	0.9
2004a	Lincoln	9	176	12	6.8
	Sublette	6	59	1	1.7
	Sweetwater	29	1,369	12	0.9
2004b	Lincoln	8	270	46	17.0
	Sublette	9	75	4	5.3
	Sweetwater	28	1,264	20	1.6
2005a	Lincoln	10	208	14	6.7
	Sublette	12	96	4	4.2
	Sweetwater	24	1,440	34	2.4
2005b	Lincoln	14	137	14	10.2
	Sublette	13	154	7	4.6
	Sweetwater	27	923	22	2.4
2006a	Lincoln	9	317	6	1.9
	Sublette	13	159	3	1.9
	Sweetwater	29	1,290	24	1.9
2006b	Lincoln	12	306	11	3.6
	Sublette	11	157	1	0.6
	Sweetwater	30	1,433	9	0.6
2007a	Lincoln	19	402	7	1.7
	Sublette	9	131	3	2.3
	Sweetwater	30	1,416	17	1.2

[1] Source: Wyoming Housing Database Partnership, 2007.

"Non-traditional" housing plays a large role in Southwest Wyoming's housing supply. This includes RVs, motels, and worker camps (Sublette SE, 2007). An August 2006 plan to build a worker camp in Farson (Sweetwater County) was fought and defeated by local residents (Gearino, 2006). There is pressure on the housing market, and finding a place to rent in Sublette County can be difficult (Sublette SE, 2007).

The market is responding to increased demand for housing in Southwest Wyoming. Building permits and per-unit valuation of new construction increased between 2000 and 2006 in Southwest Wyoming (Table 3.5-17). In Sublette and Sweetwater counties, the median sale prices of single-family homes have increased at paces exceeding the statewide trends (Sublette SE, 2007).

Table 3.5-17
Building Permits and Valuation for Southwest Wyoming from 2000 to 2006[1]

		Authorized construction in permit issuing areas					Per-unit valuation, 1000s of real 2006 dollars
Year	**County**	**Single-family Units**	**Duplex Units**	**Tri- and Four-plex Units**	**Multi-family Units**	**Total Units**	**Single-family Units**
2000	Lincoln	145	0	0	0	145	155.90
	Sublette	54	0	0	0	54	151.50
	Sweetwater	36	0	0	5	41	155.70
2001	Lincoln	214	0	4	0	218	159.00
	Sublette	72	4	0	0	76	158.70
	Sweetwater	38	0	0	0	38	190.20
2002	Lincoln	192	0	4	8	204	163.20
	Sublette	74	6	8	0	88	166.10
	Sweetwater	48	0	0	0	48	171.60
2003	Lincoln	180	0	0	0	180	172.90
	Sublette	83	4	8	0	95	167.50
	Sweetwater	63	0	0	0	63	193.60
2004	Lincoln	206	2	4	0	212	171.80
	Sublette	77	12	4	0	93	181.10
	Sweetwater	216	0	0	0	216	169.80
2005	Lincoln	253	8	0	0	261	173.30
	Sublette	179	0	0	6	185	137.30
	Sweetwater	260	0	0	0	260	157.80
2006	Lincoln	232	4	7	0	243	177.00
	Sublette	232	0	0	6	238	152.00
	Sweetwater	236	0	8	24	269	167.30

[1] Source: U.S. Census Bureau, 2007 and Wyoming Housing Database Partnership, 2007.

Sublette County has a relatively limited supply of existing housing, which reflects its historically low population. Historically, Sublette County's housing market has generally followed trends in the county's population. Figure 3.5-4 compares changes in the county's population with changes in the number of housing units. It shows that changes in the housing market are not as dramatic as population changes, and tend to lag population growth. Changes in Sublette County's supply of housing may be constraining future growth; between 2000 and 2006, Sublette County's population increased 24.3 percent while it's housing stock increased by 16.6 percent.

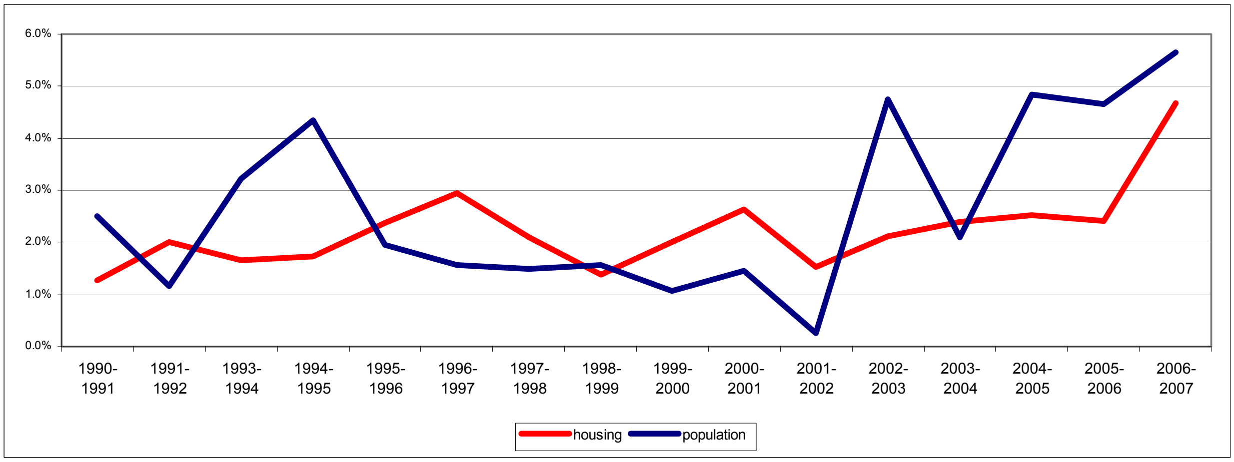


Figure 3.5-4
Annual Change in Sublette County's Population and Number of Housing Units
(Source: U.S. Census Bureau, 2007)

Residential sales are another indicator of population pressures (Figure 3.5-5). Throughout the 1990s, the number of houses sold annually in Pinedale and Sublette County remained relatively flat. High-end homes accounted for a large portion of the sales. Between 1990 and 1999, the average residential sale price increased 168 percent in Sublette County (from $55,896 to $149,920) and 174 percent in Pinedale (from $43,360 to $118,782). The county's housing market began to swing upward in 2000. Between 2000 and 2006, the number of annual residential sales in Sublette County increased 123 percent, and the county-side average residential sale price increased 125 percent, from $142,338 to $285,677. During this time, the number of annual home sales in Pinedale increased 119 percent, and the average residential sale price in Pinedale increased 148 percent, from $116,972 to $264,200.

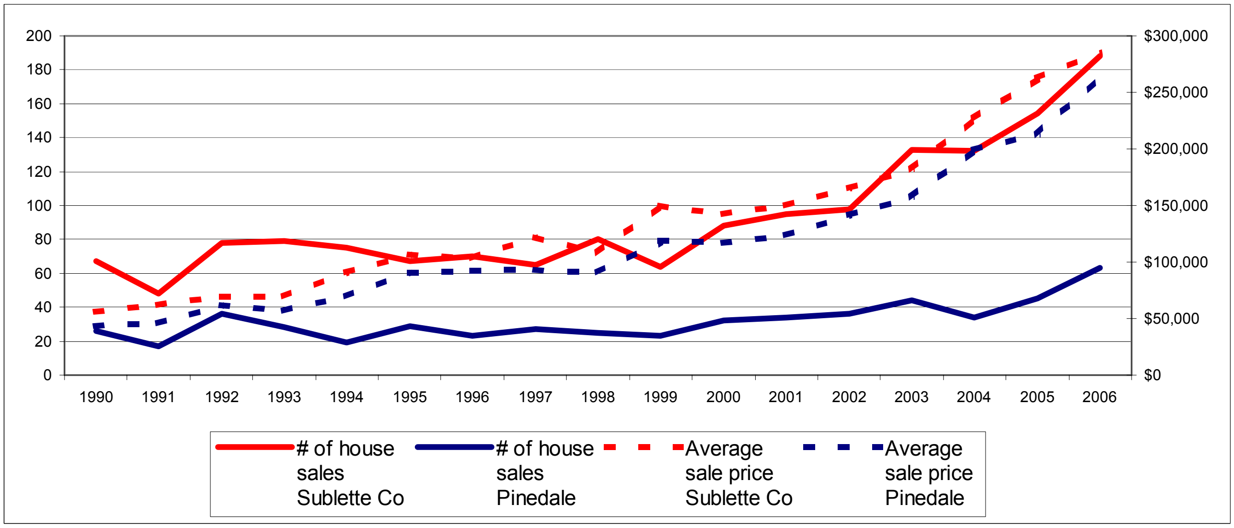


Figure 3.5-5
Residential Sales in Sublette County and Pinedale, 1990 - 2006
(Source: Sublette County Assessor's Office, 2007)

Many of the houses sold in Sublette County are financially out-of-reach for the average wage-earner in the county. The U.S. Department of Housing and Urban Development estimates the median family income in Sublette County to be about $59,000. Given a 30-year mortgage at 7 percent interest, a family at this income level with good credit and few debts can afford a house in the $225,000 price range (Sublette SE, 2007). In 2006, 42 percent of the 201 houses that were sold (84 units) in Sublette County cost $225,000 or less (Figure 3.5-6).

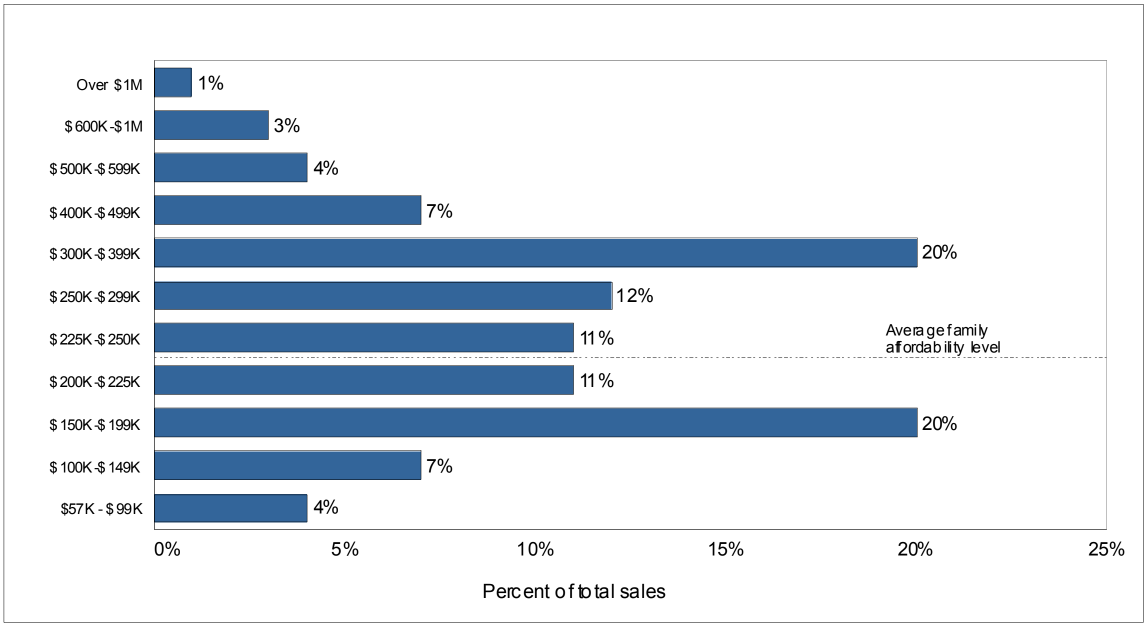


Figure 3.5-6
2006 Home Sales in Sublette County by Price Range
(Source: Sublette County Assessor's Office, reported in Jacquet, 2007)

3.5.7 Infrastructure

Southwest Wyoming covers 19,469 square miles (4,089 square miles in Lincoln County, 4,883 square miles in Sublette County, and 10,497 square miles in Sweetwater County). Sweetwater County is transected east and west by Interstate 80. Rock Springs and Green River are located 19 miles apart on I-80. Pinedale is located 100 miles northwest of Rock Springs on U.S. Highway 191. Kemmerer is located 70 miles northwest of Green River on U.S. Highway 30.

3.5.7.1 Transportation

Rock Springs is serviced by two commercial airlines providing daily flights to and from Denver International Airport. Kemmerer is serviced by one commercial airline providing daily flights to and from Salt Lake City International Airport. Sublette County is serviced by two private airports. Alpine and Afton are each serviced by one private airport. Rock Springs is serviced by two bus lines, four car rental services, and two taxi services.

3.5.7.2 Fire Protection Services

Fire protection is provided by four fire departments in Lincoln County, three fire departments in Sublette County, and ten fire departments in Sweetwater County (Capitol Impact, 2007). The 24-member Pinedale Volunteer Fire Department (PVFD) serves the PAPA (Mitchell, 2006). The PVFD purchased a new rescue truck in 2003 with town funds (drawing on tax revenues from the PAPA). The PVFD brought a hazardous materials trailer into use in the summer of 2006. The fire-fighting emergency response capabilities have been adequate to meet demands from the

PAPA to date (Mitchell, 2006). The Operators are responsible for responding to fires that occur in the PAPA, while the PVFD is responsible for maintaining a buffer perimeter around the fire (Mitchell, 2006).

3.5.7.3 Law Enforcement

First-call police services to the PAPA are provided by the Sublette County Sheriff's Department. Sublette County is the only county in Wyoming that has sheriff services with no local police services. Since 2000, the Sheriff's office has added eight officers and detectives. There are currently 32 officers in Sublette County (Wyoming Attorney General, 2007). The county is trying to add more officers to handle vacancies, mostly created due to officers who are in the military reserves. The Sheriff's Department experiences high employee attrition because wages and benefits paid by the oil and gas operators are higher than county wages (Hanson, 2007). Sublette County Commissioners are sensitive to this issue and are working to raise wages. The Sheriff's Department's current staffing is adequate to handle county traffic control including drunken driving issues. Traffic problems, drunk driving, domestic issues, and bar fights have been increasing with the increase in population. The greatest increases have been for drug-related offenses (see Table 3.5-18). The Sublette County Sheriff's Department runs more patrols of oil fields and has greater visibility in the community than it had prior to 2000, because of increased staffing. The PAPA does not pose as difficult a patrolling challenge as the Jonah Field Project Area because the PAPA is closer to Pinedale; however, in winter the response time is longer because the gates are closed. An emergency medical service/fire response building that will house a paramedic response truck is under construction. This will cut down on response time to the fields. The Sublette County Sheriff's Department is equipped to meet its current responsibilities (Hanson, 2007).

Table 3.5-18
Adults Arrested by Sublette County Sheriff's Department for Select Offenses, 1999-2006[1,2]

	1999	2000	2001	2002	2003	2004	2005	2006
Simple Assaults: No weapon used/no serious injury	19	33	41	32	30	36	45	50
Drug Abuse Violation: Possession	21	14	13	14	36	33	64	35
Driving Under the Influence	75	63	47	59	84	110	117	69

[1] Source: Wyoming Attorney General, 2007.
[2] An arrest is counted for each separate occasion an individual is taken into custody, and although several charges may be placed against an individual, only one arrest is counted each time.

Law enforcement providers in Sweetwater and Lincoln counties have also felt the effects of growth in the PAPA. According to McConkie (2006), the Kemmerer Police Department has experienced increased demand for police services since 2000 due to regional growth in oil and gas activity. The City of Kemmerer has responded by providing budget increases to pay for additional officers to keep up with the demands. In the City of Rock Springs, the police department has noticed an increase in oil and gas personnel who work in the PAPA but live and recreate in Sweetwater County (Keslar, 2007). In addition to a rise in index crimes (Sublette SE, 2007), there are increases in petty crimes, such as drunkenness in public and traffic control issues, that consume a large portion of officers' time (see Table 3.5-19). Recent data indicate that index crimes increased more than historical data would have predicted (Sublette SE, 2007). Rock Springs recently received approval to add six officers to its current roster of 44, but finding individuals and providing adequate training has proven difficult (Keslar, 2007). Of the 44 officers on payroll, 38 operate independently on patrol.

Table 3.5-19
Adults Arrested by Rock Springs Police Department for Select Offenses, 1999-2006[1,2]

	1999	2000	2001	2002	2003	2004	2005	2006
Simple Assaults: No weapon used/no serious injury	51	48	61	49	84	81	104	109
Drug Abuse Violation: Possession	61	57	102	87	199	196	296	239
Driving Under the Influence	156	147	246	195	172	241	283	281

[1] Source: Wyoming Attorney General, 2007.
[2] An arrest is counted for each separate occasion an individual is taken into custody, and although several charges may be placed against an individual, only one arrest is counted each time.

Drug use, in particular methamphetamine use, is an increasingly difficult and prevalent problem in Southwest Wyoming. Southwest Counseling Service in Rock Springs is the drug treatment facility that serves the region (Schmid, 2006). In fiscal year 2003-2004, the number of diagnoses made for methamphetamine dependence exceeded the number of alcohol dependence diagnoses for the first time in the agency's history. Eighty percent of arrests in Sweetwater County are associated with methamphetamine use (Schmid, 2006). The Wyoming legislature has responded to the methamphetamine problem with additional laws and funding. In 2005, $9 million was allocated for community efforts to combat methamphetamine distribution and addiction.

3.5.7.4 Medical Services

The Sublette County Rural Health Care District provides first call emergency medical services to the PAPA (McGinnis, 2006). The Rural Health Care District serves as the umbrella organization for the Sublette County Emergency Medical Services (Sublette County EMS) and the Pinedale and Marbleton-Big Piney clinics. Sublette County EMS encompasses three divisions: Pinedale, Big Piney, and Sand Draw (which will open soon). Pinedale and Big Piney have three ambulances each, and Sand Draw will have one. In 1999, the District's emergency medical crews were volunteers but now it has full-time paid medics and partially compensated volunteers. There is funding for a total of twelve medics, but they only have eight. The lack of medics is reported to stem from an inability to find affordable housing. Three of the medics live outside Sublette County. Services will be stretched even tighter when the Sand Draw facility opens and staff will be spread thinner; however, this facility is considered necessary as the volume of calls coming from that direction has been increasing and the facility will allow them to reduce response time by about 30 minutes. Sublette County EMS used to see seasonal fluctuations, but now it is more consistent across the year, averaging 70 runs a month (see Figure 3.5-7). Patients requiring emergency medial care receive treatment at the Pinedale Clinic, the Memorial Hospital of Sweetwater County located in Rock Springs, and St. John's Medical Center in Jackson (Gay, 2007).

Trauma-related transports by Sublette County EMS increased from 101 in 2000 to 308 in 2006 (Ostby, 2007). Trauma victims from the PAPA are transported to hospitals in Salt Lake City by the Memorial Hospital of Sweetwater County's helicopter.

The Pinedale Clinic sends dozens of referrals per week to the Memorial Hospital of Sweetwater County (Beltran, 2007). Trauma incidents referred to Memorial Hospital did not increase between 2000 and 2005 and the hospital is equipped to meet its current demand. Most of the referrals from the PAPA to Memorial Hospital are broken bones, bruises, and lacerations. Minor trauma and emergency room visits have increased in the past two years. Although Memorial

Hospital is not experiencing a strain on its emergency services provision, it is currently doubling its emergency room capacity with new construction (Beltran, 2007).

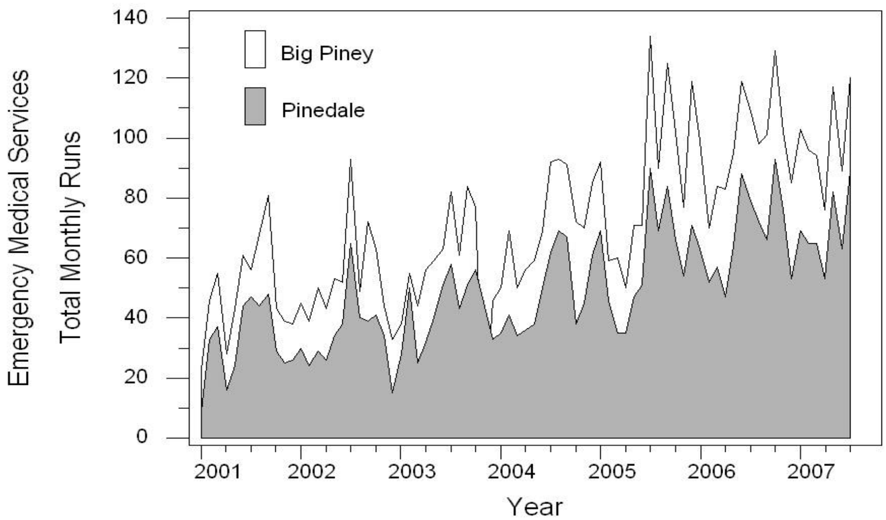


Figure 3.5-7
Sublette County EMS Monthly Runs from Pinedale and Big Piney, 2001-2007
(Source: Sublette County EMS,2007)

Sublette County is the only county in Wyoming that does not have a hospital. Medical services include two public clinics; seven independent physicians; two physician assistants; four dentists; emergency medical services with ambulances and trained medics; and a nursing home with 107 rooms (Wyoming Healthcare Commission, 2006). The Pinedale Medical Clinic serviced (including during and after office hours) approximately 13,203 patients in 2005 (Sublette County Rural Health Care District, 2006). This represents a 9 percent increase from the 12,000 patients serviced in 2003 (BLM, 2006e). A new clinic building is under construction. The Marbleton-Big Piney Clinic serviced approximately 6,000 patients in 2005 (Sublette County Rural Health Care District, 2006). These two clinics are administered by physicians under contract with the Sublette County Rural Health Care District. There is also a private clinic in Marbleton (Sublette SE, 2007).

The main center for medical services in Sweetwater County is Memorial Hospital of Sweetwater County with a 99-beds that provided 22,000 days of emergency room care, 2,900 days of in-patient care, and 2,400 days of out-patient care in 2005, and 21,660 days of emergency room care and 2,347 days of in-patient care in 2006 (Beltran, 2007). Memorial Hospital coordinates emergency care services for Southwest Wyoming. There are 40 consulting physicians affiliated with the hospital. Seven dentists practice in Rock Springs. In Green River, the Castle Rock Medical Center coordinates care with four physicians and four physician's assistants. There are three nursing homes in Sweetwater County.

In Lincoln County, two medical centers coordinate primary and urgent-care services. The South Lincoln Medical Center in Kemmerer has a 16-bed hospital facility which provided 1,023 patient-days of care in 2005. There were 16,352 clinic visits and 2,439 emergency room visits in 2004 (up from 2,039 emergency room visits in 2003). There were 12,984 clinic visits, 2,739 emergency room visits, and 569 patient-days of care in 2006 (Moffet, 2007). There are two satellite clinics, two family practice physicians, one physician's assistant, and one family nurse practitioner located in southern Lincoln County. In the northern part of the county, the Star Valley Medical Center has a 24-bed hospital facility. There are six independent physicians in Afton and Alpine has one clinic staffed by a family nurse practitioner. There are two nursing homes in Lincoln County.

3.5.7.5 Lodging

Hotel and motel accommodations in Lincoln County include 16 hotels and motels with 350 rooms, three guest ranches, and one bed and breakfast. In Sublette County, there are 23 hotels and motels, with a total of 629 rooms, three RV parks totaling 83 spaces, three bed and breakfasts, and 11 guest ranches. In Sweetwater County, there are five convention facilities (with a total capacity of 4,660 persons), 31 hotels/motels (1,680 total rooms), an RV park (50 spaces), and several mobile home parks.

According to the Wyoming Department of Revenue (2007), lodging taxes collected in Sublette County increased from $9,000 in 2001 to $235,000 in 2006. This marked increase coincides with the county's influx of oil and gas workers (Ecosystem Research Group, 2007). Historically, occupancy levels at lodging facilities in Sublette County have varied seasonally, with the highest occupancy levels occurring during the summer tourist season; however, hotels and motels are now usually booked to capacity throughout the drilling season (Ecosystem Research Group, 2007).

3.5.7.6 Libraries

Each county has a library system. The Lincoln County Public Library has four branches with 112,452 volumes total. The Sublette County Public Library, located in Pinedale, with one branch in Big Piney, has 80,000 volumes total. There has been an increase in demand for services over the past couple of years, but even more so in the past year. This includes a demand for library cards, as well as increases in circulation, the use of public internet computers, and requests for items in languages other than English. The two meeting rooms are booked constantly. The Pinedale location is constructing a new wing, which will add another meeting room as well as a conference room (Platts, 2007). The Sweetwater County Public Library has nine branches with 207,000 volumes total.

3.5.7.7 Schools

There are five school districts in Southwest Wyoming. Table 3.5-20 shows trends in school enrollments between 2000 and 2007 across the region. Schools in Sublette County are experiencing increased enrollments.

Table 3.5-20
Trends in School Enrollment in Southwest Wyoming between 2000 and 2007[1]

	10/1/2000	10/1/2001	10/1/2002	10/1/2003	10/1/2004	10/1/2005	10/1/2006	1/29/2007
Lincoln #1	789	724	668	669	622	629	627	630
Sublette #1	639	630	671	689	701	767	841	861
Sublette #9	569	587	571	592	591	617	646	642
Sweetwater #1	4,665	4,401	4,264	4,193	4,197	4,240	4,413	4,399
Sweetwater #2	2,928	2,774	2,688	2,650	2,620	2,582	2,551	2,522

[1] Source: Wyoming Department of Education, 2007.

The decision process regarding school facilities involves the Wyoming School Facilities Commission, which was established by the 2002 Legislative session. The Commission oversees school facilities, including planning, assessing, financing, construction, and maintenance (Wyoming School Facilities Commission, 2007a).

Lincoln County has recently closed one elementary school but it could be reopened. Two of their buildings are seismically unsound and will be rebuilt; based on current projections, they are not being built with room to expand (Chaulk, 2006). In a few years, they will be building additions to the Kemmerer Middle and High Schools (Wyoming School Facilities Commission, 2007b).

Sweetwater County School District #2 (Green River) recently closed three elementary schools. Even with these closures, they have capacity for 100 additional elementary school students. Green River High School was built in 1996 for 1,400 students. With a current enrollment of 693, it has considerable room for expansion in the 7th through 12th grades (VanMetre, 2006). Sweetwater County School District #1 (Rock Springs) has seen recent increases in numbers of kindergarten through 6th grade students. They are nearing capacity in their elementary schools. Construction on a new elementary school in LaBarge began in August 2007 (Wyoming School Facilities Commission, 2007b). LaBarge also has ample capacity to expand in their 7th through 12th grade schools. There were 980 high school students enrolled at the end of the 2005-2006 school year in a building that held 1,200 students in the 1990s (Lopiccolo, 2006).

Both Sublette County school districts report effects on their enrollments from the development in the PAPA (Anschutz, 2006 and McAdams, 2007). Sublette County School District #1 is constrained for space in the middle school; its expansion is currently under construction, and a new middle school is in the long range plan. Elementary schools are constrained for space and are using modulars; they will need to build a new elementary school within 5 years. The biggest increase during the 2006-2007 academic year was in the elementary school population, which was considerably up, with an average daily membership of 380. The high school has space to expand. There were 232 enrolled students at the end of the 2005-2006 school year, and they expect 260 students for 2006-2007, but up to 300 could be accommodated (McAdams, 2007). Sublette County School District #9 has experienced no growth in middle school or high school enrollments but is seeing growth in elementary school populations. They are short of space in their elementary school buildings (Anschutz, 2006).

3.5.7.8 Communications

Communications in Southwest Wyoming include three weekly newspapers in Lincoln County, two weekly newspapers in Sublette County, and one weekly and one daily newspaper in Sweetwater County. There are two radio stations in Lincoln County, two in Sublette County, and six in Sweetwater County.

3.5.8 County and Local Government Revenues

Sales tax is a foundational source of revenue for Southwest Wyoming. The State of Wyoming imposes a base sales tax rate of 4 percent in all counties. The State keeps approximately 70 percent of sales tax revenues and about 30 percent is returned to the county in which the sale occurred. Sales tax returns are distributed to county governments and municipalities based on population.

Counties and municipalities can also impose a general and/or specific purpose tax up to a maximum of 1 percent for each tax; these are returned by the State, minus an administrative fee. A lodging tax of up to 4 percent can be imposed, which is also returned to the county or municipality of origin, minus an administrative fee (WDAI, 2007a).

Lincoln County imposes a 1 percent general purpose tax. Kemmerer levies a 2 percent lodging tax. In 2005, sales tax collections from mining ($2.3 million) represented 16 percent of total (state and local tax) collections in Lincoln County ($14.7 million). In 2006, the total sales tax collection from mining was $3.5 million.

Sublette County has no general or specific purpose tax, although it does impose a lodging tax of 3 percent. In 2006, the largest source of sales tax revenue in Sublette County was from mining (51 percent), while the total (state) mining collection was $24.6 million. This differs markedly from the rest of Wyoming, where retail sales account for 36 percent of sales tax revenue. In Sublette County, 13 percent of sales tax revenues were from retail sales and 14 percent were from wholesale sales.

Sweetwater County has a 1 percent general purpose tax, and a 2 percent lodging tax. In 2006, total (state and local) sales tax collection from mining ($19 million) represented 24 percent of total collections in Sweetwater County ($79.4 million). This represents sales tax collection on sales by the mining sector, not the sales tax paid by the mining industry.

Sublette County and its municipalities receive portions of two types of tax revenues based on oil and gas production in the PAPA: ad valorem taxes, and severance taxes. Municipalities also receive a portion of federal mineral royalties.

An ad valorem tax is a tax on property that applies to all minerals in Wyoming. Ad valorem taxes go directly to the county in which the commodity is produced. They are divided into production taxes, which are levied on assessed valuation (Table 3.5-21), and property taxes. The total 2005 assessed valuation in Sublette County was $2.9 billion, a six-fold increase since 2000.

Table 3.5-21
Production and Sales of Oil and Gas from the PAPA

Year	2000	2001	2002	2003	2004	2005	2006
Production[1]							
Gas (MSCF)	10,587,252	21,701,861	61,747,523	109,864,089	180,398,607	237,909,623	284,789,614
Oil (barrels)	100,405	210,127	550,857	881,926	1,424,753	1,869,043	2,201,685
Sales/production Ratio[2]							
Gas	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%
Oil	100%	100%	100%	100%	100%	100%	100%
Sales:							
Gas (MSCF)	9,337,956	19,141,041	54,461,315	96,900,126	159,111,571	209,836,287	251,184,440
Oil (barrels)	100,405	210,127	550,857	881,926	1,424,753	1,869,043	2,201,685

[1] Source: WOGCC, 2007.
[2] Source: Wyoming Department of Revenue, 2007 and WOGCC, 2007.

A severance tax is an excise tax imposed on the value of the gross product. The mineral severance tax is collected and distributed by the Wyoming Department of Revenue. The base oil and gas rates are each 6 percent. Of the 6 percent, 0.25 percent is returned to counties and 0.75 percent to cities and towns (Wyoming Business Council, 2007). In 2006, Sublette County received $72,775 in severance tax distribution, Pinedale received $65,891, Marbleton received $33,599, and Big Piney received $19,039 (Lummis, et al., 2007).

Estimated ad valorem and severance tax distributions from PAPA natural gas wells between 2000 and 2006 are presented in Table 3.5-22.

Table 3.5-22
Estimated Ad Valorem and Severance Tax Revenue from PAPA, 2001 to 2006[1]

Year [1]	2001	2002	2003	2004	2005	2006
Ad Valorem Tax[2]						
Rate on Gas (per MSCF)	$0.17	$0.18	$0.10	$0.20	$0.25	$0.32
Rate on Oil (per barrel)	$1.64	$1.27	$1.34	$1.60	$2.11	$2.74
Ad valorem Gas	$1,799,833	$3,906,335	$6,174,752	$21,972,818	$45,099,652	$76,131,079
Ad valorem Oil	$164,664	$266,861	$738,148	$1,411,082	$3,006,229	$5,121,178
Ad valorem Total	$1,964,497	$4,173,196	$6,912,901	$23,383,899	$48,105,881	$81,252,257
Severance Tax						
Rate on Gas (per MSCF)	$0.14	$0.15	$0.09	$0.18	$0.23	$0.30
Rate on Oil (per barrel)	$1.39	$1.11	$1.22	$1.52	$1.95	$2.58
Severance Gas	$1,435,631	$3,283,492	$5,551,102	$20,127,101	$42,014,836	$72,491,062
Severance Oil	$139,242	$233,493	$670,558	$1,336,735	$2,778,126	$4,814,094
Severance Total	$1,574,873	$3,516,985	$6,221,661	$21,463,836	$44,792,961	$77,305,156

[1] Source: Wyoming Department of Revenue, 2007.
[2] Tax revenue for ad valorem and severance tax is based on the previous year's production and prices.

A mineral royalty is the amount of money paid to the owner of the mineral resource by the mineral producer. Wyoming receives a base royalty of 16.7 percent of the value of production from state-owned minerals. The federal government receives a royalty of 12.5 percent of the value of production for federally-owned minerals. Federal mineral royalties (FMR) paid to the State of Wyoming from PAPA natural gas wells are shown in Table 3.5-23. Fifty percent of FMR are returned to the state, minus a 1 percent administration fee, a portion of which is distributed to municipalities (counties do not receive FMR). In 2006, Pinedale received $154,000 in federal mineral royalties; Marbleton received $86,000; and Big Piney received $55,000 (Lummis et al., 2007).

Table 3.5-23
Federal Mineral Royalties Paid to the State of Wyoming from PAPA Natural Gas Wells[1]

Source	2001	2002	2003	2004	2005	2006
Rate on gas (per MSCF)	$0.29	$0.13	$0.20	$0.16	$0.25	$0.31
Rate on Oil (per barrel)	$1.41	$0.99	$1.33	$1.54	$1.84	$2.68
FMR – Gas	$6,271,838	$7,718,440	$22,412,274	$28,863,777	$59,477,406	$88,854,360
FMR – Oil	$295,859	$547,001	$1,168,552	$2,195,544	$3,446,515	$5,893,911
FMR – Total	$6,567,697	$8,265,441	$23,580,826	$31,059,321	$62,923,921	$94,748,270

[1] Source: Minerals Management Service, 2007.

The federal government manages 49 percent of land in Wyoming, including 75 percent of Lincoln County, 77 percent of Sublette County, and 69 percent of Sweetwater County. Federal lands are not subject to property taxes that support county governments and education. In 1976, Congress authorized federal land management agencies to share income with states and counties through its Payment In Lieu of Taxes (PILT) program. In 2006 in Lincoln County,

$817,726 was returned to the county on 1,952,608 acres enrolled in the PILT program, an effective payment of $0.42 per entitlement-acre. In 2006 in Sublette County, $491,999 was returned to the county on 2,431,285 acres enrolled in the PILT program, an effective payment of $0.20 per entitlement-acre. In 2006 in Sweetwater County, $1,699,067 was returned to the county on 4,611,015 acres enrolled in the PILT program, an effective payment of $0.37 per entitlement-acre (Foulke et al., 2007).

3.5.9 Natural Gas Prices

Increases in natural gas prices are an important factor influencing Operator's decisions regarding the number of wells to drill and the level of production from existing wells. From 2000 to 2006, the average wellhead price paid for Wyoming natural gas increased (Table 3.5-24).

Table 3.5-24
Average Prices Paid at the
Wellhead in Wyoming 2000 to 2006[1]

Year	Price $/MCF
2000 annual average	$3.42
2001 annual average	$3.66
2002 annual average	$2.09
2003 annual average	$4.41
2004 annual average	$5.17
2005 annual average	$7.19
2006 through June	$5.97

[1] Source: Bentley and DeBruin, 2007.

3.6 TRANSPORTATION

3.6.1 Development in the PAPA

The primary route to the PAPA is U.S. Highway 191. The main route through the PAPA is State Highway 351 (Map 2.3-2 in Chapter 2). Before issuance of the PAPA ROD (BLM, 2000b), access within the PAPA was limited to a few county roads, BLM roads, oil and gas roads, and a number of two-track roads. Numerous local and resource roads have been constructed throughout the PAPA in conjunction with natural gas development since issuance of the PAPA ROD. Most collector roads existing prior to issuance of the PAPA ROD have been upgraded and/or expanded, and one new collector road has been constructed (North Anticline Road).

Collector roads provide primary access in the PAPA and generally receive the highest traffic volume of the three classes. Local roads provide access to multiple well locations while resource roads provide access to individual well locations and receive the lowest traffic volume. As of November 2006, there were 185.6 miles of roads in the PAPA as a result of wellfield activities. Of this, 61.6 miles are collector roads, 57.7 miles are local roads, and 66.3 miles are resource roads.

3.6.1.1 Traffic Volume

Vehicle traffic volumes within and adjacent to the PAPA have increased since 2000. For example, daily traffic on State Highway 351 was estimated at 640 vehicles per 24 hours (with 110 trucks per 24 hours) in 2000. By 2006, traffic volume had more than tripled to 2,230 vehicles per 24 hours, while truck traffic increased to 540 trucks per 24 hours (Wyoming

Department of Transportation – WDOT, 2007a). Likewise, traffic on U.S. Highway 191, measured near the junction with Wenz Airport Road, increased from 1,700 vehicles per 24 hours (180 trucks per 24 hours) in 2000 to 3,150 vehicles per 24 hours (330 trucks per 24 hours) in 2006. Traffic on U.S. Highway 189 measured near the junction with Airport Road increased from 1,400 vehicles per 24 hours in 2000 (130 trucks per 24 hours) to 4,070 vehicles per 24 hours (740 trucks per 24 hours) in 2006 (WDOT, 2007a). Table 3.6-1 summarizes average vehicles per day estimated for different road sections near the PAPA in 2000 and in 2006.

According to WDOT (Roadifer, 2006), all sections of U.S. Highway 191 are rated Level of Service C based upon current traffic volumes. In WDOT's 2005 analysis of U.S. Highway 191, there was an increase of 58 percent of overall traffic with a 90 percent increase in truck traffic between 2002 and 2005. The volume increase caused the downgrade to a Level of Service C. Similar analysis has not been done by WDOT for State Highway 351. WDOT tries to maintain all roads at a Level of Service C or higher. Anything below a Level of Service C would necessitate road improvements (Roadifer, 2006).

Table 3.6-1
Average Number of Vehicles Per Day on Highways Used to Access the PAPA[1]

Section Description	Section Milepost		Pre-ROD (before July 2000)		Post-ROD (as of November 2006)	
	Begin	Length (miles)	All Vehicles	Trucks	All Vehicles	Trucks
U.S. Highway 191						
Sweetwater – Sublette County Line	51.62	21.33	1,500	240	3,340	840
Jct. Speedway Road	72.81	3.95	1,500	240	2,830	640
Jct. Route 1801 (WY 351)	76.75	7.75	1,300	160	2,280	240
Jct. Fish Hatchery Road	84.50	3.30	1,200	150	2,570	270
Jct. Route 1804 (WY 353)	87.80	4.99	1,600	170	2,610	280
Jct. Wenz Airport Road	92.80	2.70	1,700	180	3,150	330
Jct. County Road 221 East & West	95.50	3.00	1,800	190	3,560	360
Jct. County Road 121 East	98.50	0.49	1,900	210	4,270	380
Pinedale South Corp Limits	98.99	0.40	3,100	230	5,190	370
Jct. Fremont Lake Road	99.39	0.89	4,600	240	7,070	370
Pinedale West Corp Limits	100.27	0.76	3,000	230	6,690	360
Jct. County Road 144 North	101.03	4.51	2,400	240	3,890	330
Jct. Route 352 (WY 352)	105.54	4.93	1,900	230	2,590	250
U.S. Highway 189						
Lincoln-Sublette County Line	85.92	3.88	900	160	1,490	240
Jct. County Road 139 East	100.16	2.57	1,000	190	1,530	250
Jct. County Road 134 West	102.73	1.89	1,250	200	2,450	520
Big Piney South Corp Limits	105.81	0.13	2,150	240	4,180	800
Jct. Route 1800 (WY350)	105.94	0.37	3,800	350	5,930	870
Big Piney North Corp Limits	106.32	0.61	4,100	270	6,190	680
Marbleton South Corp Limits	106.93	0.54	2,950	210	5,000	690
Marbleton North Corp Limits	107.47	0.50	1,850	150	4,520	830
Jct. Airport Road	107.97	1.41	1,400	130	4,070	740

Section Description	Section Milepost		Pre-ROD (before July 2000)		Post-ROD (as of November 2006)	
	Begin	Length (miles)	All Vehicles	Trucks	All Vehicles	Trucks
Jct. Route 1801 (WY 351)	109.38	18.0	980	100	1,430	280
State Highway 351						
Jct. Route 11 (U.S. 189)	0	12.91	640	110	2,230	540
Jct. County Road 136 North	12.91	11.27	280	40	1,620	500
Jct. Route 13 (U.S. 191)	0	6.70	400	50	550	30
[1] Source: WDOT, 2007a.						

Comparable traffic volume data before and after issuance of the PAPA ROD (BLM, 2000b) are not available for wellfield roads within the PAPA; however, several monitoring studies at various sites and times throughout the PAPA indicate an increase in traffic volume. For example, Ingelfinger (2001) recorded 12 vehicles per day on the Mesa Road during May and June, 1999. Holloran (2005) measured traffic by axle counts: 113 axles per day (57 vehicles per day if all had 2 axles, 38 vehicles per day if all had 3 axles) on the Mesa Road in 2001. The next year (2002), traffic volume on the Mesa Road decreased, as well as in subsequent years compared to predevelopment volumes (i.e., 22 axles per day in 2002). Most likely, after 2001, wellfield traffic (113 axles per day in 2001) was using the newly constructed North Anticline Road instead of the Mesa Road, portions of which have been reclaimed.

Holloran (2005) also recorded traffic volumes on the Jonah North Road from mid-March through mid-May, which indicated that traffic volume on this road has been increasing since 2001: 59 axles per day in 2001, 73 axles per day in 2002, 125 axles per day in 2003, and 257 axles per day in 2004.

The PAWG Transportation Task Group recommended traffic monitoring to the BLM in September 2005, and the BLM provided funds for a traffic monitoring site within the PAPA. A radar sensor was installed to collect traffic volume data, although data are not yet available. In August and September 2005, WDOT installed multiple pneumatic traffic counters throughout the PAPA and Jonah Field Project Area. An estimated average of 1,763 vehicles traveled the combined field road network on each of 2 days sampled, with estimates of 1,141 passenger vehicles, 226 single-unit trucks, 328 single-trailer trucks, and 68 multi-trailer trucks.

Winter 2005-2006 was the first time traffic volume was monitored during winter drilling and well production in the PAPA. Traffic information was gathered from November 15, 2005 through April 30, 2006 at the ASU access station (BLM, 2005b) located 400 feet south of the Pinedale/Gobblers Knob Compressor Station (SW¼ NW¼ Section 2, T. 31 N., R. 109 W.), at the main entry point to well field facilities on the Mesa. As each vehicle passed the station, the attendant identified it by specific type: light vehicles including cars, pickup trucks, SUVs and vans, while heavy vehicles were buses, tankers, dump trucks, semi-tractor trailers, among other types. Monthly average traffic volume per day, beginning November 15, 2005 and ending April 30, 2006, is summarized in Table 3.6-2.

In 2006, Questar funded a traffic study, beginning in mid-January and lasting through March. Forty-four traffic counters were placed on the Mesa, including resource roads to individual well pads, local roads to several well pads, and collector roads, including several locations along the North Anticline Road. Some counters were placed on local and resource roads leading to well pads with liquids gathering systems, while other counters were placed on roads to well pads

Table 3.6-2
Average Number of Vehicle Types Per Day
Passing the ASU Access Station During Winter 2005-2006

Vehicle Type	November	December	January	February	March	April	Period Average
Light Vehicles	206.8	191.0	149.0	191.0	156.7	165.3	173.4
Heavy Vehicles	136.4	96.2	79.0	96.2	69.8	72.9	87.4
Total Vehicles	**343.2**	**287.2**	**228.0**	**287.2**	**226.5**	**238.2**	**260.8**

without liquids gathering systems. Counters documented traffic volume to well pads where there was winter drilling by several operators. All traffic data was reported as the median number of vehicles (hits) counted per day during the functional period of each counter (Western EcoSystems Technology, 2006).

Traffic counters placed on the North Anticline Road at various distances from the junction with the Paradise Road show diminishing traffic volumes with increasing distance from the junction (Table 3.6-3). Counters farther from the junction recorded traffic to fewer well pads (assuming all traffic to those destination pads accessed the Mesa from Paradise Road). Traffic related to winter drilling is evident by comparing vehicle round trips (Table 3.6-3) from the counter at 6.93 miles from Paradise Road (21 daily round trips to access 25 well pads) to data from the closer counter, 5.54 miles from the junction (60 daily round trips to access 37 well pads).

Traffic volumes associated with winter drilling and the influence of liquids gathering systems on daily traffic are evident from traffic counters placed on local roads and, especially, on resource roads (Table 3.6-4). Average daily traffic to well pads with liquids gathering systems is half the traffic to pads without.

Table 3.6-3
Traffic Counter Locations, Traffic Volumes, and Wellfield Components Accessed
Beyond each Counter on the North Anticline Road from mid-January through March, 2006

Distance from Counter to Paradise Road (miles)	Median Vehicle Round Trips per Day [1]	Pads Accessed [2]	Producing Wells Accessed [3]	Pads with Liquids Gathering Systems [4]	Wells with Liquids Gathering Systems [4]	Pads with Winter Drilling [5]	Maximum Wells Drilled in Winter [6]
0.62 [7]	253	106	228	53	125	7	60
1.87 [8]	175	82	185	53	125	6	54
5.54 [8]	60	37	82	36	79	2	10
6.93 [8]	21	25	52	24	51	0	0

[1] Round trips are assumed to be half of the vehicles counted by traffic counters or the actual vehicle count at the access station.
[2] Total number of well pads digitized in 2005 that were beyond each counter's location, assuming all vehicle access was from south to north.
[3] Total number of producing wells from WOGCC (2007).
[4] Questar (Wexpro) pads and wells were assumed to have a liquids gathering system; other Operators were not.
[5] Winter drilling by Questar, Anschutz, Shell, and Ultra.
[6] Maximum wells drilled based on all APDs on winter-drilled pads reported by WOGCC.
[7] Data reported by the access station for mid-January through March, 2006.
[8] Western EcoSystems Technology, 2006.

Table 3.6-4
Comparisons of Vehicle Traffic to Well Pads With and Without Liquids Gathering Systems and the Effects of Winter Drilling on Traffic Volume[1]

Resource Road to Well Pad	Sample Size	Averaged Median Vehicle Round Trips per Day	Average Producing Wells Accessed	Vehicles per Day per Producing Well
Without Liquids Gathering System	3	2.67	1.67	1.60
With Liquids Gathering System	8	1.31	2.00	0.66
With Liquids Gathering System and Winter Drilling	2	66.25	4	16.56

[1] Source: Western EcoSystems Technology, 2006.

The traffic study was replicated in 2007 with 45 traffic counters installed on resource, local, and collector roads beginning in mid-January, extending through mid-March (Western EcoSystems Technology, 2007). Traffic counters were again placed on the North Anticline Road at various distances from the junction with the Paradise Road and traffic counts showed a decrease with distance from the junction, similar to the pattern described in Table 3.6-3. Data collected in 2007 on local and resource roads leading to well pads with and without liquids gathering systems also showed a similar distinction to that collected in 2006 (Table 3.6-4); there were, on average, more vehicle round trips per day to well pads without a liquids gathering system (1.6 round trips per day per pad) than to well pads with a liquids gathering system (1 round trip per day per pad).

As in 2006, traffic volumes related to winter drilling in 2007 far exceeded traffic volumes associated with production activities on well pads. Median daily traffic on three resource roads leading to pads with wells drilled during winter 2007 averaged 44.2 round trips per day (vehicles entering and leaving a pad each day). The evaluation period varied from 38 to 55 days depending on the pad. Traffic to one well pad where well completion(s) took place in 2007 averaged 12 round trips per day for 70 days. Traffic volume during any given day in that period was highly variable, ranging from less than 5 to over 65 round trips per day (Western EcoSystems Technology, 2007).

3.6.1.2 Vehicular Crashes

The total number of vehicular crashes and people injured or killed in Sublette County has increased annually from 2000 through 2006 (Table 3.6-5). In 2000, there were 271 total crashes, three fatalities, and 90 persons injured, compared to a total of 316 crashes, 11 fatalities, and 162 persons injured in 2006. Table 3.6-5 summarizes the data collected from 2000 through 2006 for vehicular crashes on U.S. Highway 189 from MP 0.0 to MP 131.45, U.S. Highway 191 from MP 0.0 to 110.05, and State Highway 351 from MP 0.0 to 24.18.

On U.S. Highway 191 between Rock Springs and Daniel Junction, crashes increased 39 percent from 142 in 2001 to 197 in 2006. A 130 percent increase in crashes was recorded along State Highway 351, connecting U.S. Highway 189 and U.S. Highway 191, where nine crashes were reported in 2001 and 21 crashes were reported in 2006. From Interstate 80 to Daniel Junction, there were 547 crashes reported by the WDOT from 2001 through 2006 on U.S. Highway 189. Crash frequency along this section of road has remained fairly constant over the 5 years.

Table 3.6-5
Number of Vehicular Crashes on Roads Adjacent to the PAPA[1]

Year	Persons Injured	Persons Killed	Property Damage Only	Injury Crashes	Fatal Crashes	Total Crashes
2000	90	3	207	62	2	271
2001	87	6	201	60	5	266
2002	91	3	222	58	2	282
2003	100	8	217	70	8	295
2004	95	5	233	67	5	305
2005	106	8	259	74	7	340
2006	162	11	224	83	9	316

[1] Source: WDOT, 2007b.

Although the total number of crashes has increased on U.S. Highway 191 and State Highway 351 over the past 5 years, the crash rate (total number of crashes/daily vehicle miles) has remained constant. For State Highway 351, the average crash rate is 1.22, slightly lower than the statewide average 1.62 for a Class 07 (major collector - rural) road. The average crash rate on U.S. Highway 191 is 1.66, slightly higher than the statewide average of 1.51 for a Class 2 (principal arterial) road. Additionally, the average crash rate for U.S. Highway 189 is 1.44, slightly lower than the statewide average of 1.51 for a Class 6 (minor arterial –rural) road (WDOT, 2007b).

WDOT (Carpenter, 2006) has recorded multiple wildlife-vehicle collisions. Since 1999, most vehicular collisions have been with mule deer though some pronghorn and fewer moose and elk have been killed on area highways including U.S. Highway 191, U.S. Highway 189, and State Highway 351 (see Wildlife and Aquatic Resources, Section 3.22).

3.6.1.3 Maintenance

Increased traffic volume on roads within and adjacent to the PAPA has resulted in a greater need for road repairs and upgrades, including additional lanes and widening of roads and shoulders. As a result, maintenance expenditures have increased since 2000 (WDOT, 2006). WDOT is responsible for maintaining U.S. Highways 191 and 189 and State Highway 351, all of which are used to access the PAPA. Although maintenance requirements on these highways increased (Table 3.6-6), WDOT's funding levels remained constant from 2000 to 2005. Sublette County maintains the county roads servicing the PAPA. The Operators are responsible for preventive and corrective maintenance of all BLM roads within the PAPA.

Table 3.6-6
Highway Maintenance
Expenditures (dollars) from 2000 through 2005[1]

Year	U.S. Highway 191	U.S. Highway 189	State Highway 351
2000	15,564	18,000	17,500
2001	21,500	23,000	28,500
2002	20,400	36,700	34,400
2003	19,200	25,000	54,700
2004	27,900 [2]	21,200	204,300 [2]
2005	156,300 [2]	28,100	65,800

[1] Source: WDOT, 2006.
[2] Includes chip sealing projects but not asphalt patching and snow plowing.

3.6.2 Pipeline Corridors and Gas Sales Pipelines

A regional network of federal, state, county, local, and rural roads provides the basic transportation infrastructure for access to the proposed corridor/pipeline alignments. Many of the local/rural roads have been improved and are maintained by oil and gas operators. North-south trending U.S. Highways 189 and 191 provide principal access to the northern half of the proposed corridor/pipeline alignments (Map 2.4-1 in Chapter 2). In addition to federal and state highways, access to the corridor/pipeline alignments and the New Fork River crossing north of State Highway 351 would be via the Paradise Road and South Boulder Road that parallel the New Fork River on the north and south sides, respectively.

The proposed BCC, R6 pipeline, and PBC pipeline alignments cross the east-west aligned State Highway 351. Access to the proposed corridor/pipeline alignments south of State Highway 351 would be via numerous BLM and local/rural roads, including BLM Road 5406, Burma Road, BLM Road 5410, Sublette County Road 139, Reardon Draw Road, County Line Road bordering Sweetwater and Sublette County, Sweetwater County Road 8, the Farson Cutoff Road, Sweetwater County Road 52, and BLM Road 4202.

The BFGC and Segment 2 of the R6 Pipeline alignments south of the Green River would be accessed via State Highway 372, U.S. Highway 30 and BLM, county, and local/rural roads. Access to the proposed corridor/pipeline alignments between the Granger Gas Processing Plant and the Blacks Fork Processing Plant would be via State Highway 375, Sweetwater County Road 16 (Granger Road), Old Little America Road, Uinta County Road 233 (Granger Road), and other local/rural roads. Access routes from the proposed OPC and Opal Loop III Pipeline alignment south of the Green River to the Pioneer and Opal gas processing plants would be via U.S. Highway 30, State Highway 240, and BLM Road 4209.

Some existing roads are parallel or adjacent to portions of the proposed corridor/pipeline alignments; this is not the case for most of the alignments. The local/rural roads are principally graveled or surfaced with native material and typically support low traffic volumes, with the exception of the roads used to access areas of oil and gas development. These rural areas and the roads accessing these areas are more remote than access from more frequently traveled routes, which may impede rapid emergency detection and response (Goehring and Sundeen, 1999).

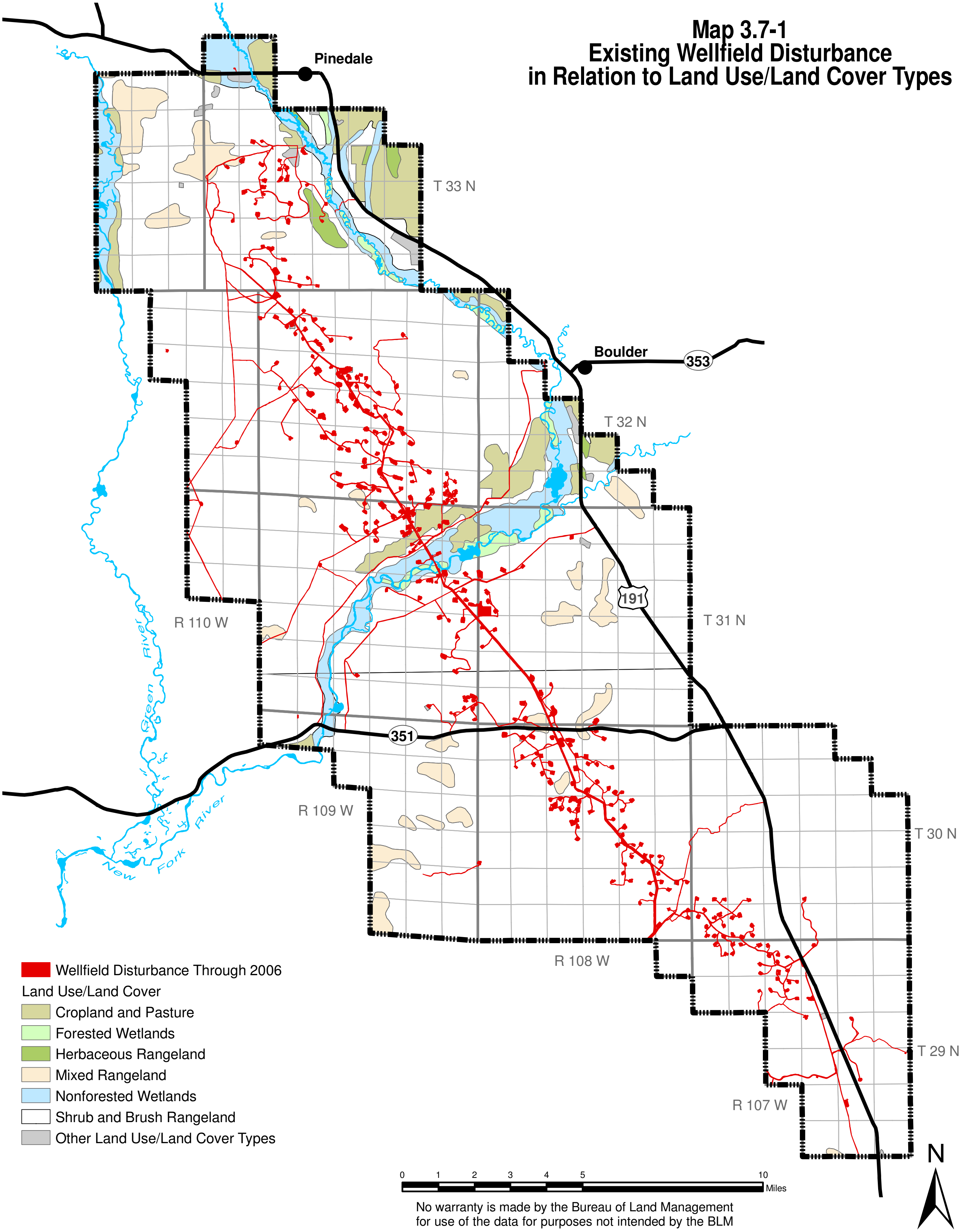
3.7 LAND USE AND RESIDENTIAL AREAS

3.7.1 Development in the PAPA

3.7.1.1 Land Use/Land Cover

Present land use and land cover in the PAPA was categorized using the United States Geological Survey (USGS) classification system (Anderson et al., 1976), the same system used in the PAPA DEIS (BLM, 1999a). There are 13 categories of USGS classified land uses in the PAPA (Map 3.7-1). Table 3.7-1 provides the total surface area of each land use/land cover type defined within the PAPA and included in the PAPA DEIS.

Shrub and Brush Rangeland and Mixed Rangeland are the predominant land use/land cover types in the PAPA, with a combined total of over 178,200 acres. The Cropland and Pasture type is mostly on bottomlands of the Green and New Fork rivers. Most Nonforested Wetlands are associated with riparian areas or are otherwise proximate to rivers and are mostly on private land.


Map 3.7-1
Existing Wellfield Disturbance
in Relation to Land Use/Land Cover Types
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Land Use/Land Cover
Cropland and Pasture
Forested Wetlands
Herbaceous Rangeland
Mixed Rangeland
Nonforested Wetlands
Shrub and Brush Rangeland
Other Land Use/Land Cover Types
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Existing surface disturbance associated with natural gas development in the PAPA is shown in Table 3.7-1. In the USGS classification system, land uses associated with wellfield components would convert an otherwise undisturbed land use category in Table 3.7-1 to be either Transportation, Communications, Utilities (roads, and pipelines) or Industrial (well pads and other wellfield ancillary facilities). Natural gas related surface disturbance has changed land use/land cover types in the PAPA in approximate proportion to their pre-1999 extent (Table 3.7-1). Land uses have not been reclassified using the USGS system since the issuance of the PAPA ROD (BLM, 2000b). Most wellfield development in the PAPA has been in the Shrub and Brush Rangeland land use type which represents approximately 96 percent of the PAPA.

Table 3.7-1
Existing Wellfield Disturbance in Relation to Land Use/Land Cover Types

Land Use/Land Cover Type	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Cropland and Pasture	7,595	55.4	7.7	63.1
Forested Wetlands	1,542	0.1	6.6	6.7
Herbaceous Rangeland	855	0.0	5.6	5.6
Industrial	70	31.2	9.2	40.4
Mixed Rangeland	6,278	43.6	0.0	43.6
Nonforested Wetlands	8,965	0.8	39.0	39.8
Reservoirs	23	0.0	0.0	0.0
Residential	180	0.0	0.0	0.0
Sandy Areas Other than Beaches	97	0.0	3.9	3.9
Shrub and Brush Rangeland	172,007	4,008.3	621.6	4,629.9
Mines, Quarries and Gravel Pits	167	1.6	0.0	1.6
Transitional Areas	32	0.0	0.0	0.0
Transportation, Communication, Utilities	226	0.0	0.0	0.0
Total	**198,037**	**4,141.0**	**693.6**	**4,834.6**

3.7.1.2 Sublette County Comprehensive Plan and Zoning

Wyoming State Statutes (Title 9-8-301 and Title 18-5-202) provide for the development of county-level comprehensive plans. The statutes also encourage county planning coordination with federal land and resource management agencies. These locally developed, adopted, and implemented county plans apply to the unincorporated areas within the county and may address public health, safety, moral, and general welfare issues.

The Sublette County Comprehensive Plan was completed in 2003 and revises the 1978 plan. The 2003 plan solidifies contemporary versions of the county's vision, goals, and formal land use policies but allows for future revisions and amendments. The purpose of the County Plan is to provide a consistent and clear direction for future land use decisions and development guidelines for officials and policy makers to craft "socially, economically and ecologically sound" decisions (Sublette County, 2003). Key components of the County Plan include:

- The County's unique culture - characterized by a rural, "Wyoming" essence - shall be preserved and enriched through a thriving private business sector, a healthy working family-based environment, and friendly, crime-free communities.

- Economic freedom shall pervade and provide diverse opportunities through reasonable taxation, low cost of living, limited regulation, and wise development of natural resources.
- The natural environment shall reflect the high value residents place on clean air and water, wide open and rural landscapes, and a healthy, diverse base of natural resources including water, land, minerals, oil, gas, plants, and animals.
- The county shall remain free of excessive land use regulation and protect private property rights.

The Sublette County Zoning and Development Regulations (Sublette County, 2002) were revised in 2007. The regulations aid in implementing the Sublette County Comprehensive Plan, provide for orderly and well-planned development within the County, protect the various land uses and zones from harmful encroachment by incompatible uses, and ensure that land allocated to a zoning district is not usurped by inappropriate uses. Detailed descriptions of the PAPA's 11 zoning districts (Map 3.7-2) are provided in the PAPA DEIS (BLM, 1999a) and the Sublette County Zoning and Development Regulations.

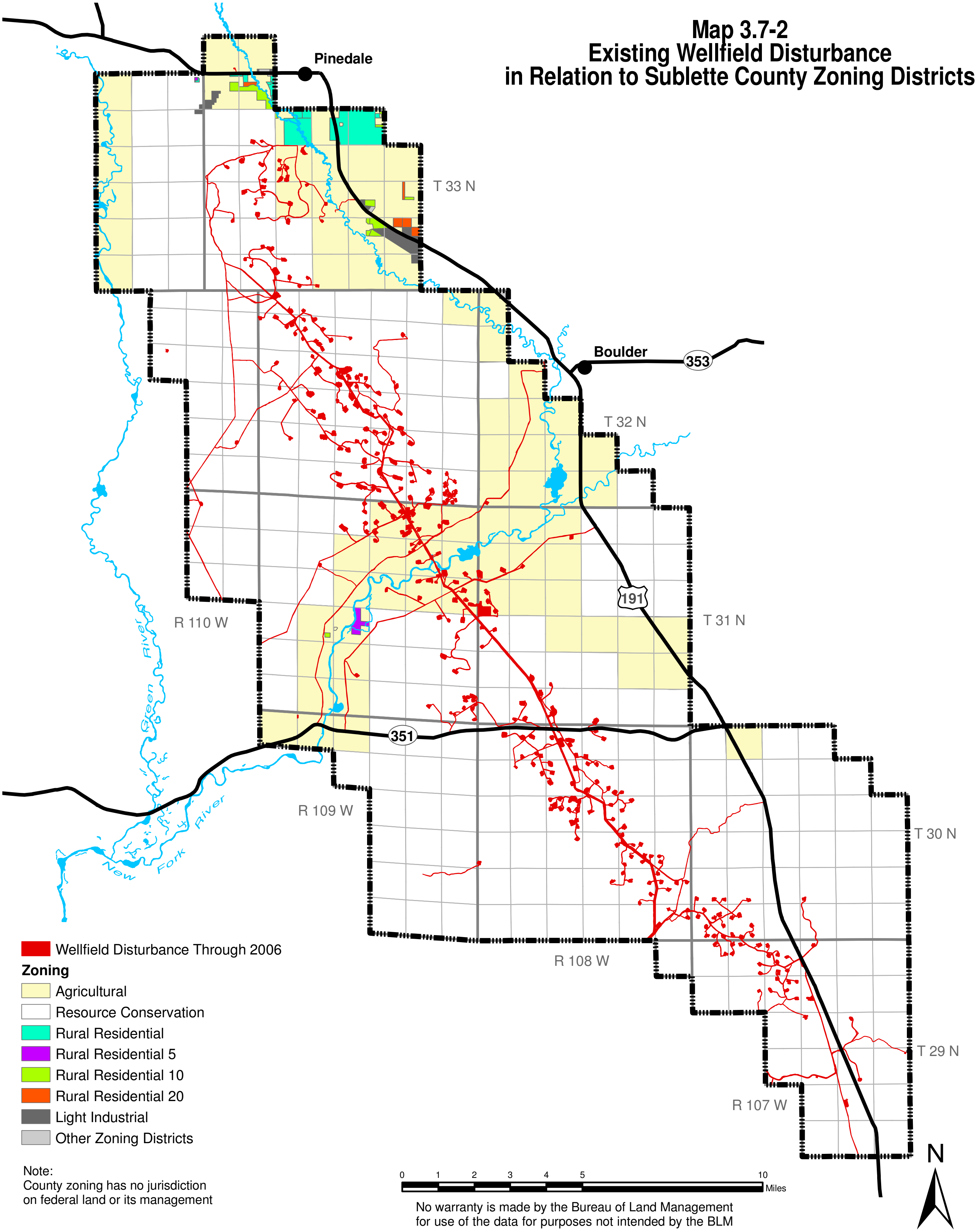
Table 3.7-2 provides the total area and existing wellfield disturbance within the PAPA in each zoning district. The Resource Conservation Zoning District, in which development is limited in order to protect and conserve environmentally sensitive areas, encompasses approximately 75 percent of the PAPA (Sublette County, 2002). Most of the area within the PAPA which is designated as Resource Conservation is on federal lands and minerals ownership. As of November 2006, over 3,800 acres had been disturbed in the Resource Conservation Zoning District, which is nearly 80 percent of all wellfield disturbance in the PAPA (Table 3.7-2).

While Sublette County has included BLM-administered public lands in their zoning districts, normally the county has no jurisdiction on these lands. The Sublette County Comprehensive Plan advocates that land use plans developed by the BLM and other federal agencies be coordinated and consistent with the Sublette County Comprehensive Plan and the Sublette County Conservation District Natural Resource Statement.

Table 3.7-2
Existing Wellfield Disturbance in Relation to Sublette County Zoning Districts

Sublette County Zoning District	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Agricultural	46,528	779.9	222.8	1,002.7
Highway commercial	33	0.0	0.0	0.0
Heavy industrial	37	0.0	0.0	0.0
Light Industrial	457	0.0	0.0	0.0
Rural residential	1,398	0.0	0.1	0.1
Rural residential 10	364	0.0	0.0	0.0
Rural residential 20	167	0.0	0.0	0.0
Rural residential 5	128	0.0	0.0	0.0
Rural residential mobile/manufactured home 10	34	0.0	0.0	0.0
Resource Conservation	148,875	3,361.1	470.7	3,831.8
Rural mixed	16	0.00	0.00	0.0
Total	**198,037**	**4,141.0**	**693.6**	**4,834.6**

Map 3.7-2 Existing Wellfield Disturbance in Relation to Sublette County Zoning Districts



3.7.1.3 Residential Areas and Subdivisions

Most land in the PAPA that is zoned for residential use by Sublette County is concentrated in the northern portion of the PAPA Residential areas represent an estimated 2,091 acres of the PAPA and are primarily within or adjacent to Pinedale and Boulder. According to Sublette County Planning and Zoning data, there are 43 subdivisions in or overlapping the PAPA, with eight subdivisions added since issuance of the PAPA ROD (BLM, 2000b).

The PAPA DEIS (BLM, 1999a) established the Residential SRMZ that was defined to be within 0.25 mile of existing residences and areas zoned primarily for residential use around portions of the PAPA (Map 3.7-3). The SRMZ does not include residences constructed after July 2000. Approximately 94.7 acres of the Residential SRMZ (as defined in the PAPA ROD) have been disturbed by wellfield development, through November 2006.

3.7.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments traverse rural, nonurban areas in Sublette, Sweetwater, Lincoln, and Uinta counties. All four counties are primarily rural and tied to traditional natural resource-based industries. Agricultural and mineral extraction industries, particularly oil and gas, are principal land uses. The proposed corridor/pipeline alignments through Sublette County are primarily within the Resource Conservation Zoning District. Areas in Sweetwater County crossed by the proposed corridor/pipeline alignments are zoned agricultural with some areas of minerals development. Areas in Lincoln County crossed by the proposed corridor/pipeline alignments are zoned rural. The proposed pipeline alignment in Uinta County parallels existing pipeline rights-of-way in the immediate vicinity of the Blacks Fork Plant.

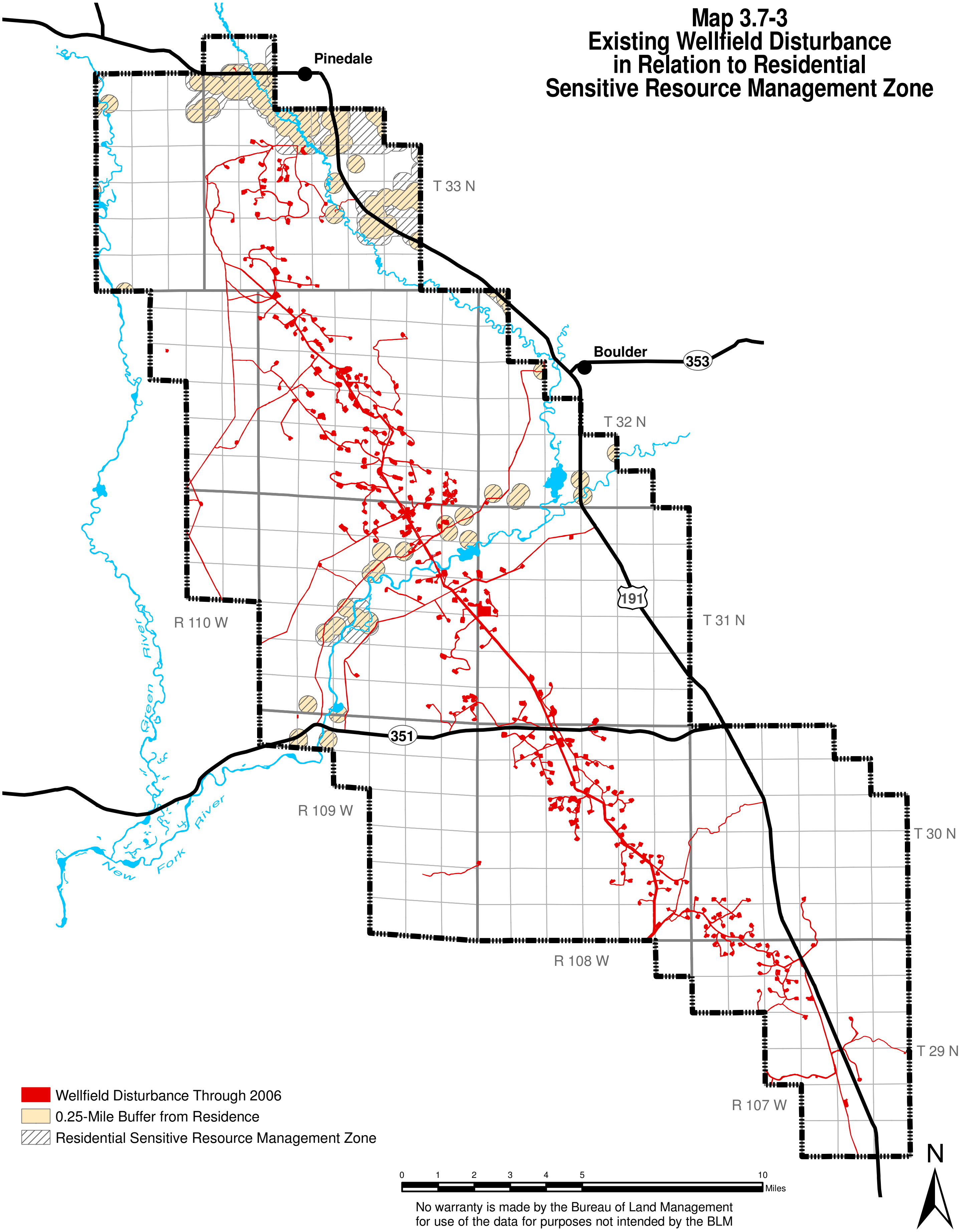
3.8 RECREATION RESOURCES

3.8.1 Development in the PAPA

3.8.1.1 Recreational Activities

A brochure promoting Sublette County recreation opportunities claims that the county is “Better than Yellowstone! Breathtaking, Wild, Uncrowded” (Sublette County Joint Tourism Promotion Board, 2006). Sublette County’s location as a gateway community for travelers en route to Yellowstone and Grand Teton National Parks is important, though the county has amenities that make it an attractive final destination.

Most recreation use in the PAPA is related to fishing on the New Fork and Green rivers and hunting. The Upper Green River Valley is also a popular destination for people seeking the benefits associated with river floating, camping, off-highway vehicle (OHV) use, hiking, horseback riding, and more. The PAPA also serves as an important outlet for locals to bike, horseback ride, walk, and generally revel in the signature scenery. These activities are common in the northern part of the PAPA, near Pinedale, the region’s largest population center. Riverboat fishing and wade fishing are also popular activities, especially on the New Fork River in the central area of the PAPA, where the river bottoms and surrounding benches coincide with scenic BLM Visual Resource Management (VRM) Class II viewsheds.


Map 3.7-3
Existing Wellfield Disturbance
in Relation to Residential
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
0.25-Mile Buffer from Residence
Residential Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Aside from a broad spectrum of tourist and residential recreation opportunities, Sublette County also has the highest population growth rate in the state. The increasing regional population and changing demographics as a result of natural gas development, retirement, and new businesses have contributed to the expanding demand for outdoor recreation access and use. Since the onset of natural gas development, and with the influx of oil and gas workers, more residents are seeking recreation opportunities and facilities on public land (BLM, 2003a). The BLM has noted marked increases in dispersed recreation, such as camping and OHV use since 2000 (Hudson, 2007 and Vlcek, 2007). Widespread OHV use is often difficult to manage and can impact an array of other resources, such as cultural and historic, grazing, wildlife, and vegetation.

Additionally, natural gas development in the PAPA affects large areas that in the past have been used for dispersed, benefits-based recreation (recreation that contributes to the users' relaxation, sense of adventure, family experiences, appreciation for the outdoors, sense of well-being, and more). It is generally assumed that areas once commonly used for benefits-based recreation will be avoided when the landscape and its qualities are changed by development. Noise, odor, increased traffic, dust, changes in setting, and other competing factors from development are typically considered intrusive and recreationists will usually avoid such areas.

The BLM Recreation Management Information System (RMIS) data for the PFO Administrative Area show that there were 200,567 total recreation days (one day spent by one person recreating) in 2006, distributed among 13 recreation activities. Table 3.8-1 summarizes the RMIS data for the years 2004, 2005, and 2006. The most common recreation uses in the region are boating and fishing, with major increases in these activities occurring in 2006. In projecting future recreation patterns, resource managers recognized that RMIS data are best professional estimates based on 30 years of general knowledge of use, and standardized collection methods are not always used. Recorded data related exclusively to the PAPA are not available (Hudson, 2007). The PAPA comprises about 21 percent (198,037 acres) of the total PFO Administrative Area (approximately 930,000 acres).

Table 3.8-1
Recreation Days in the BLM Pinedale Field Office Administrative Area[1,2]

Activity	Recreation Days 2004	Recreation Days 2005	Recreation Days 2006
Motorized Boating	292	263	282
Nonmotorized Boating	81,477	81,206	89,564
Camping and Picnicking	20,855	22,274	22,151
Driving for Pleasure	1,993	1,728	2,338
Fishing	46,832	45,941	50,798
Hunting	5,019	5,555	6,190
Interpretation, Education & Nature Study	2,899	2,710	2,943
Nonmotorized Travel	15,463	15,246	16,228
Off-Highway Vehicle Travel	1,081	1,183	1,392
Snowmobile & Other Motorized Travel	4,508	3,955	4,085
Specialized Nonmotorized Sports & Activities	1,791	2,206	2,196
Swimming & Other Water Based Activities	870	883	950
Winter Nonmotorized Activities	1,349	1,364	1,450
Total	**184,429**	**184,514**	**200,567**

[1] Source: BLM, 2007a
[2] Years are measured in the fiscal range, October 1 through September 30.

Additionally, big game hunting (pronghorn, elk, moose, and mule deer) is a major recreational activity in the PAPA. WGFD manages harvest of big game by Hunt Areas, several of which may cover big game populations' herd units. WGFD has collected hunter and harvest data needed to compute recreation-days in each of the big game Hunt Areas that coincide with or are in the immediate vicinity of the PAPA (Table 3.8-2). In 2001, there were 27,747 recreation-days of hunting in these Hunt Areas. In 2006, fewer hunters spent less time hunting resulting in 21,967 recreation-days within the same Hunt Areas. Since 2002, there has been a general declining trend in hunter recreation-days devoted to big game harvest in the Hunt Areas surrounding the PAPA. The RMIS data for general hunting recreation days show a slight increase in recent years and cover the entire PFO Administrative Area, while the WGFD data are specific to Hunt Areas.

Various game bird species, including ducks, geese, mourning doves, and greater sage-grouse, are also hunted within the PAPA and vicinity. Wildlife viewing (e.g., mule deer on winter range) on the Mesa is another local recreational activity because it is readily accessible from Pinedale.

Table 3.8-2
Resident and Non-Resident Recreation-Days of Hunting Big Game in the Vicinity of the PAPA from 2000 to 2006[1]

Hunter Category	2000	2001	2002	2003	2004	2005[2]	2006[2]
Antelope (Pronghorn) Hunt Areas 87 and 90:							
Residents	1,776	1,454	1,760	1,771	1,784	1,366	1,901
Non-Residents	795	681	649	545	830	917	1,249
Total	**2,571**	**2,135**	**2,409**	**2,316**	**2,614**	**2,283**	**3,150**
Mule Deer Hunt Areas 138, 139, 140:							
Residents	5,810	7,380	8,819	7,137	4,943	4,683	4,674
Non-Residents	908	137	1,498	1,308	852	1,071	758
Total	**6,718**	**7,517**	**10,317**	**8,445**	**5,795**	**5,754**	**5,432**
Elk Hunt Areas 96, 97, and 98:							
Residents	13,610	14,094	15,019	12,612	11,021	9,981	10,631
Non-Residents	2,991	3,801	3,676	1,305	2,886	3,220	2,626
Total	**16,601**	**17,895**	**18,695**	**13,917**	**13,907**	**13,201**	**13,257**
Moose Hunt Area 4:							
Residents	253	193	237	293	126	357	104
Non-Residents	29	7	31	336	33	17	25
Total	**282**	**200**	**268**	**629**	**159**	**374**	**129**
Total Net Economic Value of Hunting, Residents and Non-residents							
	$1,308,389	**$1,410,381**	**$1,575,935**	**$1,330,593**	**$1,090,314**	**$1,608,239**	**$1,634,656**

[1] Sources: WGFD 2000-2007 Annual Reports of Big and Trophy Game Harvest; BLM, 1988b; USDI et al., 2003.
[2] Estimates from Frost, 2007; Clause, 2007a, 2007b, and 2007c.

The USFWS collects state-level data on fishing, hunting, and wildlife-viewing every 5 years. The most recent surveys, in 1996, 2001, and 2006, were used to estimate the rate of change in recreation demand for Wyoming (Table 3.8-3). Days spent hunting and fishing in Wyoming have decreased over the past decade, while wildlife viewing activities have increased.

Table 3.8-3
Recreation-Days Spent Fishing, Hunting,
and Wildlife Viewing in Wyoming for 1996, 2001, and 2006 [1,2]

Recreation Day Activity	Total Days 1996	Total Days 2001	Total Days 2006	Percent Change 1996-2006
Fishing	2,415,000	2, 497,000	1,743,000	27.8
Hunting	1,443,000	1,304,000	894,000	38.1
Nonresidential Wildlife Viewing Activities (away from home)	2,875,000	3,924,000	3,078,000	7.1

[1] Source: USFWS, 1998, 2003a and 2007a.
[2] For U.S. population 16 years old and older.

As noted, detailed recreation data specific to the PAPA does not exist.

3.8.1.2 Recreation Sites and Facilities

There are several developed and undeveloped recreation facilities and sites located in the PAPA which are described in detail in the PAPA DEIS (BLM, 1999a). For most sites, the area within 0.25 miles of each is included in the Recreation SRMZ.

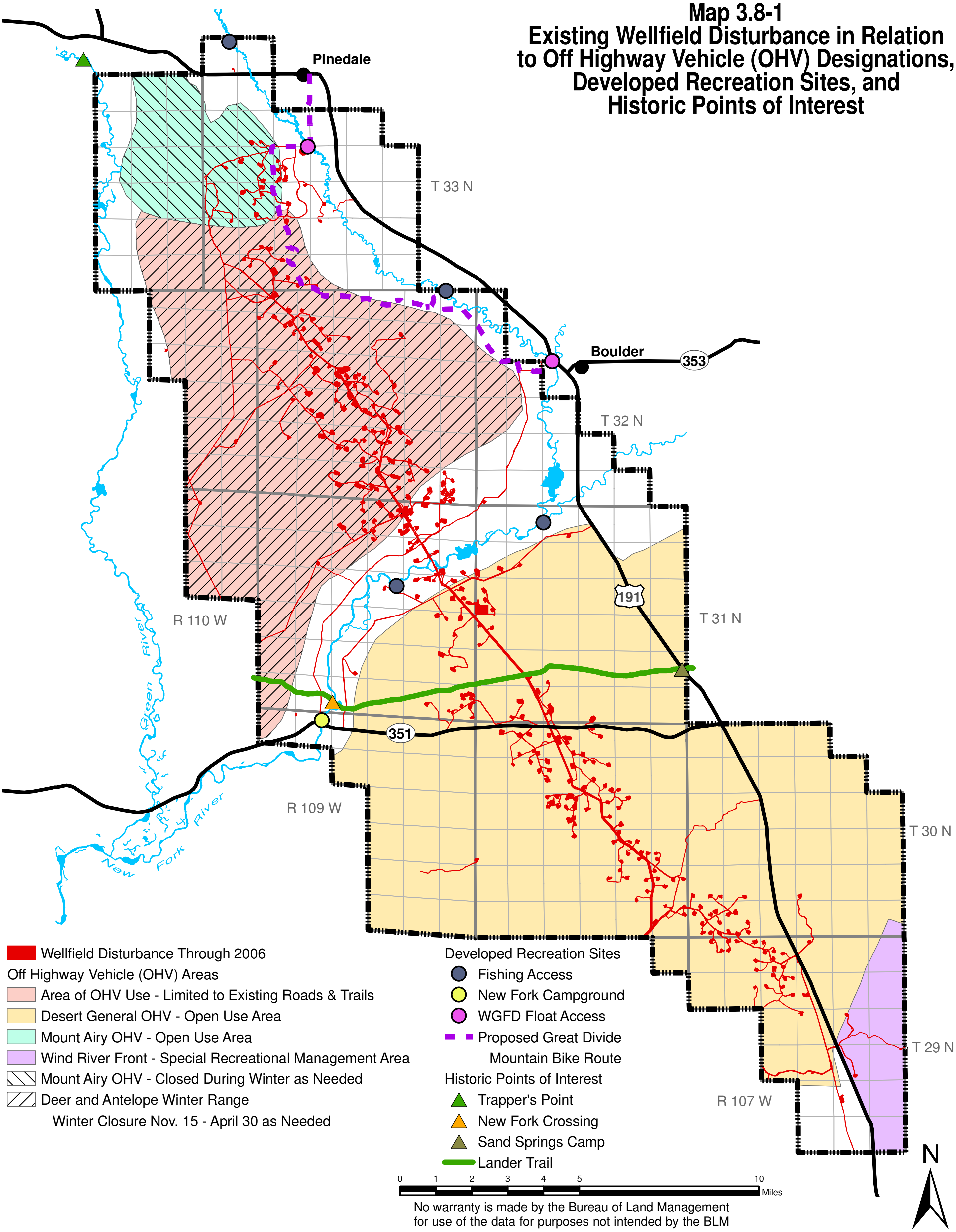
Adventure Cycling has proposed a route through the PAPA from Pinedale to Boulder which would be part of a 4,000 mile Great Divide Mountain Bike Route (see Map 3.8-1). Currently, BLM has not authorized this route and it has been removed from Adventure Cycling's guide map and brochure. There is a network of bike trails in the PAPA, called the Mesa Mountain Bike Trail; however, BLM has not finalized the maps and brochures for these trails (Hudson, 2006).

Both the New Fork and Green rivers flow through the PAPA. The current Pinedale RMP (BLM, 1988b) requires that federal lands along these rivers be managed to provide fishing and floating opportunities. The WGFD's Basin Management Plans (WGFD, 2006a) include three stream segments on the New Fork River and one on the Green River that flow through the PAPA. On the New Fork River, from Green River to East Fork River, anglers find brown trout, rainbow trout, and some dwindling populations of Colorado River cutthroat. On the East Fork River to Pine Creek, anglers find brown trout and rainbow trout and on the Pine Creek to New Fork Lake segment, anglers find brown trout and brook trout. Locations for camping, fishing access, and boating access along the New Fork and Green rivers are included in Map 3.8-1.

Currently, river floaters and anglers drive through major development areas of the PAPA to public and private access areas on the New Fork River. River access points also have direct visual exposure to natural gas development, and indirect contact with construction by way of traffic and noise. On the river segment through the central part of the PAPA, floaters pass through areas where recreationists can see, smell, and hear development. Well pads, pipeline corridors, and roads are visible from these areas which also include VRM Class II and III viewsheds.

An area in the north end of the PAPA, near Mount Airy was identified by BLM as a possible OHV use area prior to 1999. Currently, it is not being managed as an open OHV area and it has had very little use for its intended purpose. It is anticipated that the forthcoming Pinedale RMP (due for release in 2008) will greatly reduce the size of the OHV area. An OHV plan was not officially developed for the Mount Airy site, and there has been no progress in its designation (Map 3.8-1). Its inclusion in this Revised Draft SEIS provides for consistency with the PAPA ROD.

Map 3.8-1
Existing Wellfield Disturbance in Relation to Off Highway Vehicle (OHV) Designations, Developed Recreation Sites, and Historic Points of Interest



The current Pinedale RMP restricts travel on the Mesa during the winter to protect mule deer and pronghorn on winter ranges (BLM, 1998a). Other travel is limited to existing roads and trails. Seasonal use restrictions could also apply to the Mount Airy OHV Area, if needed. The Pinedale RMP designated the area south of the New Fork River a general OHV open area, and it has been open year-round to OHV use (Map 3.8-1).

A 5,141-acre area of the southeastern part of the PAPA coincides with the Wind River Front Special Recreation Management Area (SRMA) which is managed by BLM's RSFO. The portion of the SRMA in the PAPA has been managed for dispersed recreation (camping, hunting, and fishing), with full consideration given to wildlife, cultural resources, vegetation, watershed values, and mineral development activity, as specified in BLM's Green River RMP (BLM, 1997). The entire western portion of this SRMA has been open to mineral leasing.

As of November 2006, there were approximately 32 acres of wellfield disturbance in the Wind River Front SRMA that coincides with the PAPA (Table 3.8-4). Most development has been south of the New Fork River, in the Desert General OHV Open Use Area. By November 2006, there were over 2,300 acres of wellfield disturbance in this Open Use Area, with an approximate disturbance of more than 4,100 acres of wellfield disturbance in all public recreation areas.

Table 3.8-4
Existing Wellfield Disturbance in Relation to Public Recreation and OHV-Designated Areas

Recreation Area	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Mount Airy OHV Area	9,202	172.4	21.6	194.0
OHV Areas Limited to Existing Roads, Trails	48,037	1,436.7	132.2	1,568.9
Desert General OHV Open Use Area	90,362	2,058.6	258.5	2,317.1
Wind River Front Special Recreation Management Area	5,141	30.4	1.1	31.5
Total	**152,742**	**3,698.1**	**413.4**	**4,111.5**

There are several recreation sites in the region funded in part by the Land and Water Conservation Fund (LWCF) and administered by the National Park Service. Four sites are located in Pinedale and one is in Marbleton. None of the LWCF projects have been adversely impacted by PAPA natural gas development (Moore, 2007).

3.8.2 Pipeline Corridors and Gas Sales Pipelines

BLM and Bureau of Reclamation (USBR) lands that would be crossed by the proposed corridor/pipeline alignments support dispersed recreation including hiking, camping, mountain biking, fishing, river-running, sight-seeing, wildlife viewing, and hunting (Sweetwater County Joint Travel and Tourism Board, 2006). Specific destinations for recreational experiences near the proposed corridor/pipeline alignments include Fontenelle Reservoir, Seedskadee National Wildlife Refuge, and a network of historic trails.

Fontenelle Reservoir is located on the Green River 24 miles southeast of La Barge, Wyoming. The proposed OPC and Opal Loop III pipeline alignment is approximately 3.3 miles west of the Fontenelle Reservoir at its closest point. Recreation use is low volume and seasonal. Fontenelle Creek Campground has developed campsites with restrooms and running water. The creek enters the reservoir approximately 8 miles west of the OPC and Opal Loop III pipeline alignment. Three other campsites are located approximately 2 miles west of the alignment below the dam and are more primitive. Stream fishing opportunities exist on the Green River upstream and downstream from the reservoir (Sweetwater County Joint Travel and Tourism Board, 2006).

Seedskadee National Wildlife Refuge is located approximately 0.5 mile to the east of the proposed BFGC alignment along the Green River and is used by nonconsumptive recreationists (wildlife viewing). Hunters pursue numerous game species on the refuge, including pronghorn, mule deer, greater sage-grouse, and waterfowl. The Green River also offers world class trout fishing opportunities for anglers year round (Sweetwater County Joint Travel and Tourism Board, 2006). The network of historic trails in the area provides a unique recreational and historic experience for mountain bikers. The Oregon Trail, California Trail, Pony Express Trail, Mormon National Historic Trail, and the Overland Stage route are all suited to mountain biking (Sweetwater County Joint Travel and Tourism Board, 2006).

Each of the three proposed corridors and pipeline alignments crosses the Little Colorado Wild Horse Herd Management Area (HMA), which is managed by BLM's RSFO. The appropriate management level for this HMA is 100 horses. Spring and early summer are good times to watch wild horses when young foals are present (Sweetwater County Joint Travel and Tourism Board, 2006).

3.9 VISUAL RESOURCES

3.9.1 Scenic Views

The PAPA ROD (BLM, 2000b) describes the PAPA as one of "open space and solitude," with few roads and mainly void of human activity. The Mesa provides excellent views of all the mountain ranges in the area. Prior to 2000, natural gas development was limited and did not impact views across the Mesa, over the Green and New Fork river valleys, and stretching out to the Wind River and Wyoming mountain ranges. Visibility is an important component of the visual resource (Section 3.11, below).

Today the PAPA has the characteristics of a more urbanized setting. A trend is developing in which the public is becoming more sensitive to the scenic values of the area.

3.9.2 Visual Resources Management System

BLM manages visual resources in several VRM classes within the PFO Administrative Area. The PAPA contains three VRM classes; Class II, Class III, and Class IV. No lands in the PAPA are VRM Class I. These classes were developed under the Pinedale RMP (BLM, 1988b) and are subject to change under the forthcoming RMP ROD. All lands in the PAPA are rated for VRM classification; however, only the BLM-administered public lands are managed within the VRM system. Regardless of the VRM classification, BLM policy is to mitigate impacts to visual resources where and when possible. The management objectives for each VRM class within the PAPA are described in the PAPA DEIS (BLM, 1999a) and reiterated, below:

- Class II – The objective of this class is to retain the existing character of the landscape. The level of change to the character of the landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- Class III – The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV – The objective of this class is to provide for management activities which 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 the 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 found in the predominant natural features of the characteristic landscape.

3.9.3 Development in the PAPA

The most extensive natural gas development in the PAPA has been in VRM Class IV, which incorporates 126,512 acres or about 64 percent of the PAPA (see Map 3.9-1). As of November 2006, more than 3,400 acres in VRM Class IV had been disturbed by wellfield activities (Table 3.9-1). The least amount of wellfield disturbance is on lands in the VRM Class II designation, which accounts for a minor portion of federally-managed lands and minerals in the PAPA. These areas are located primarily along the river flood plains on private lands. Approximately 1 percent of the VRM Class II area has existing wellfield disturbance. The BLM has jurisdiction over approximately one-quarter (5,228.6 acres) of the lands classified VRM Class II. All VRM Class objectives require mitigation to the greatest extent practicable.

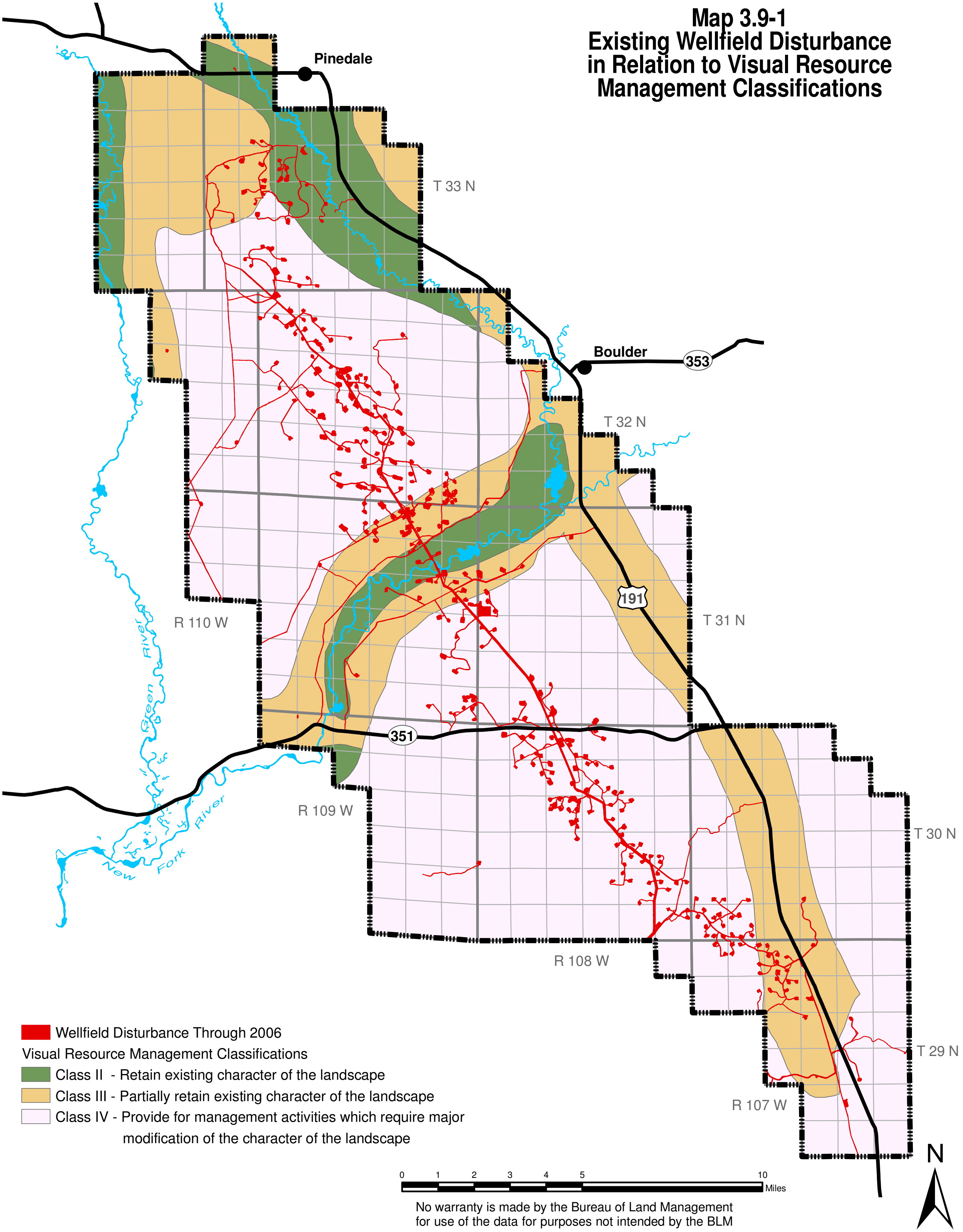
Table 3.9-1
Existing Wellfield Disturbance in Relation to Viewshed Classifications

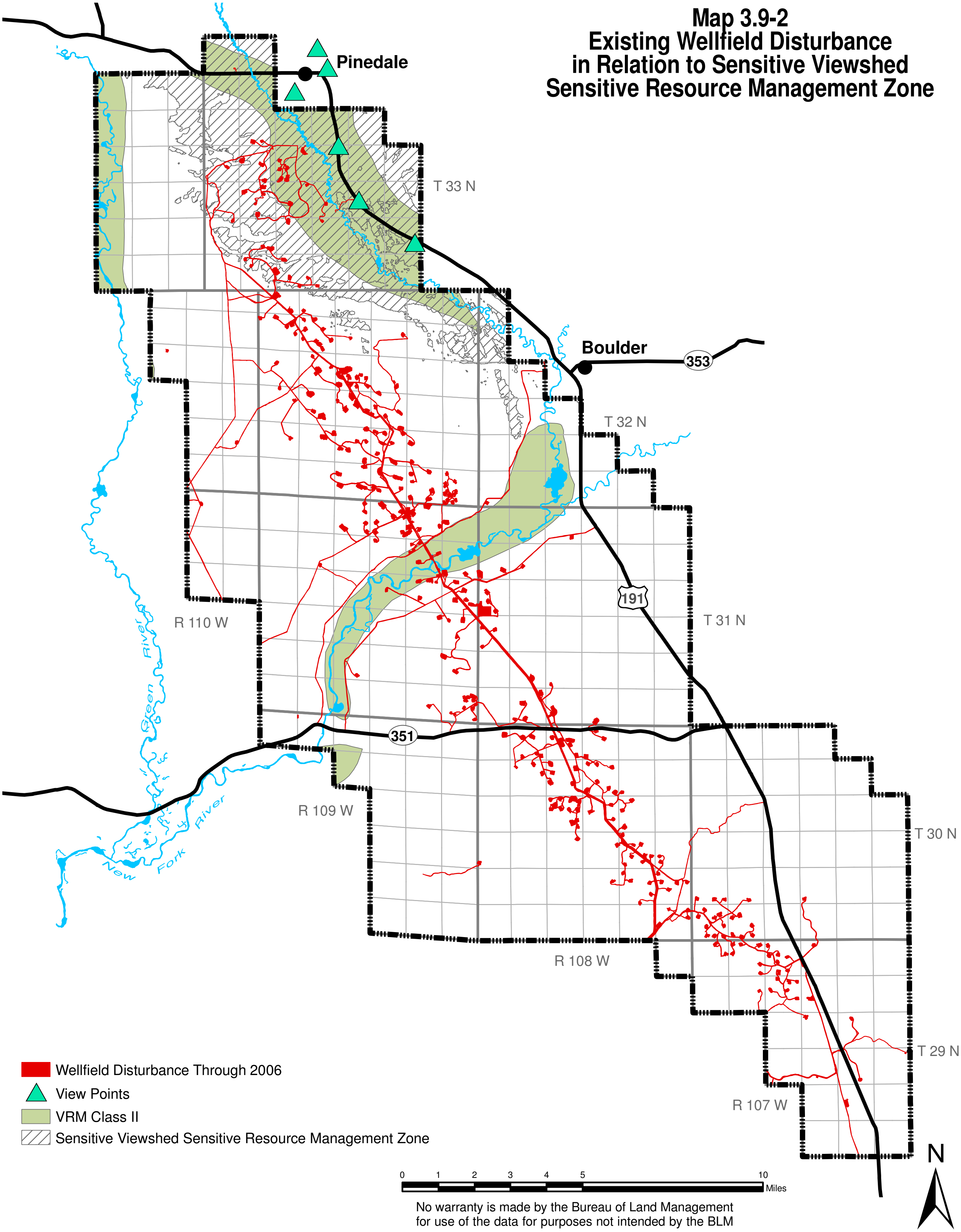
Viewshed Class	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
VRM II	22,013	80.3	170.1	250.4
VRM III	49,512	979.8	121.8	1,101.6
VRM IV	126,512	3,080.8	401.8	3,482.6
Viewshed SRMZ	21,514	363.5	0.0	363.5

The PAPA DEIS (BLM, 1999a) established a Sensitive Viewshed SRMZ to address public concerns regarding the visual sensitivity of the portion of the PAPA visible from Pinedale and U.S. Highway 191 leading into town. Visual resource degradation in this area can impact tourism, residents, and overall economic conditions. The Sensitive Viewshed SRMZ was modeled to include areas visible from six viewpoints in and around Pinedale. Map 3.9-2 shows the SRMZ, which is visible when the six view points are combined together. The view point near the Mountain Man Museum in Pinedale was recently moved because housing development obstructs the view. The view point has been replaced with another in a location about 150 yards away.

A major portion of the Sensitive Viewshed SRMZ is classified as VRM Classes II and III and is located in the northern part of the PAPA. The SRMZ covers 21,514 acres (11,497.6 acres of federal land) in the PAPA (Table 3.9-1). As of November 2006, there were 363.5 acres of wellfield disturbance in the Sensitive Viewshed SRMZ.

MA 4, which is 8,686 federal acres of sensitive viewshed established in the PAPA ROD, incorporates portions of the Sensitive Viewshed SRMZ, the ‘face of the Mesa’, and VRM Classes II and III along the Green and New Fork rivers. The management objective of MA 4 is to retain the existing character of the landscape, where management activities may be seen but should not attract the attention of the casual observer. As part of the ongoing case-by-case visual resource analysis and mitigation, BLM can require Operators to develop Visual Resource Protection Plans in some areas of MA 4, including near Pinedale and along the New Fork River (Hudson, 2007).


Map 3.9-1
Existing Wellfield Disturbance in Relation to Visual Resource Management Classifications
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Visual Resource Management Classifications
Class II - Retain existing character of the landscape
Class III - Partially retain existing character of the landscape
Class IV - Provide for management activities which require major modification of the character of the landscape
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N


Map 3.9-2
Existing Wellfield Disturbance
in Relation to Sensitive Viewshed
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
View Points
VRM Class II
Sensitive Viewshed Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Drilling rigs and heavy trucks are now common daily sights in the PAPA, especially for travelers on Paradise Road and State Highway 351. Throughout the PAPA, well pads, roads, and utility corridors can cause a high degree of visual contrast depending upon the casual observer's viewing variables such as topography, distance, light conditions, angle of observation, and length of time viewed.

3.9.4 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments cross three VRM sensitivity classes (Classes II, III, and IV) and are adjacent to existing rights-of-way for pipelines, roads, or other linear features for most of the proposed lengths.

VRM Class II areas that would be crossed by the proposed corridor/pipeline alignments are associated with the Green and New Fork rivers, their valleys/flood plains, and adjacent uplands on either side of the rivers. VRM Class III areas that would be crossed are adjacent to the Class II area along the Green River and north and south of the New Fork River. VRM Class IV areas occupy the remainder of lands crossed by the proposed corridor/pipeline alignments.

3.10 CULTURAL AND HISTORIC RESOURCES

3.10.1 Development in the PAPA

The BLM manages cultural resources on public lands in accordance with the Antiquities Act of 1906, the National Historic Preservation Act of 1966, the Native American Graves Protection and Repatriation Act, the Archaeological Resources Protection Act of 1979, and various other codes and Executive Orders. The BLM's management process is governed by the requirements of the State Protocol Agreement between the BLM and the Wyoming State Historic Preservation Office (SHPO), which was revised in 2006 (Appendix 14). Specifically, BLM management in the PAPA focuses on identifying and protecting cultural and historical sites, as well as resolving conflicts between cultural/historic resources and other resource uses (BLM, 1988b and 1999a). An overview of cultural and historic resources and site types found in the PAPA were described in the PAPA DEIS (BLM, 1999a) and the Cultural Technical Report, appended to the PAPA DEIS.

Sites are categorized according to type of cultural resources identified in a particular survey area. In the PAPA, site types include (but are not limited to) prehistoric campsites, house pits, human burial sites, lithic procurement sites, rock alignment sites (e.g. tipi rings, medicine wheels, and cairns), the Lander Trail (which is part of the National Historic Trail System), pioneer settlements, early Euroamerican homesteading remains, stock maintenance sites, and townsites (BLM, 1999a). Sites are also described as prehistoric archaeological sites and landscapes, ethno-historic sites and landscapes, historic sites and landscapes, and historic trails (BLM, 2003b). Prehistoric sites most likely to be discovered in the PAPA will probably be related to prehistoric and historic Native American hunting and seasonal activities.

The Trappers Point area north of the PAPA is known for its rich archeological sites and is a critical stock sorting area for "The Green River Stock Drift", a century-old seasonal stock driveway considered part of a potential Sublette County Rural Ranching Traditional Cultural Property and a potential Rural Historic Landscape. Terraces of the New Fork River and the Blue Rim Area carry significant site potential (those eligible for inclusion in the National Register of Historic Places - NRHP). Rock alignment sites are concentrated around the edges of the Mesa (Crume, 2006). Other historical resources in the PAPA include pioneer settlements such as the New Fork Townsite which is listed on the NRHP, the James Bertram Homestead, and the C.B. Faler Ranch. These sites are located on the perimeter of the PAPA, away from the Anticline Crest where most of the natural gas development has occurred. In the PAPA and intersecting the Anticline Crest are historic pioneer trails and travel routes including the New Fork Wagon Road, Lander Cut-off of the Oregon Trail (Lander Trail), and a wagon road from Big Piney to New Fork (BLM, 1999a).

Other historic sites in the PAPA and vicinity are associated with the early fur trade, the frontier military, railroads, the mining industry, ranching, and early oil and gas development (BLM, 1997). Approximately 75 percent of the sites found in the Green River Basin are prehistoric. Prehistoric cultural materials found at these sites include stone tools, projectile points, metates (grinding slabs), and ceramics. Archeological features frequently found include individual fire hearths, hearth clusters, and an abundance of Archaic Period (8,000 to 2,000 years ago) house pits (BLM, 1997 and Vlcek, 2006). The New Fork House Pit site contains several 6,000-year old house structures with what has been preliminarily interpreted as a structure utilized for smoking meat. This site was discovered during construction of the gas sales pipeline authorized by the PAPA ROD (BLM, 2000b).

In the PAPA DEIS (BLM, 1999a), several archeological sites eligible for the NRHP were documented along the Anticline Crest and later subjected to pipeline construction after mitigative excavations. Since the issuance of the PAPA ROD (BLM, 2000b), numerous significant sites (those eligible for inclusion in the NRHP) have been identified. During excavation of a well pad near the northern end of the Mesa, a site was discovered yielding a particularly dense concentration of prehistoric features. Salvage excavations during well pad construction recovered over 70 hearths, hearth remains, and other buried archeological materials within a 5-acre study plot. In the same vicinity, expansion of a well pad in 2006 yielded archeological discoveries as well as a unique rock alignment that required a specific management strategy.

Folsom sites are among the oldest prehistoric occupations known in North America. During 2006, a Folsom projectile point estimated to be 11,500 years old was discovered at a proposed well pad site in the southeastern portion of the PAPA; however, construction of the proposed well pad was cancelled due to the probability of a dry hole. Further, wellfield development has been proposed near a natural feature considered sensitive to modern Native Americans on the southern end of the PAPA. That proposal has required ongoing Native American consultations.

3.10.1.1 Native American Concerns

Several recognized Native American Tribal groups, including the Shoshone, Bannock, Ute, Crow, Arapahoe, and Blackfoot, as well as prehistoric peoples, frequently used the lands within and surrounding the PAPA (BLM, 1999a). Within the PAPA, BLM has identified several dozen sacred sites, sites important or considered sensitive to modern day Native Americans, as well as formally recognized Traditional Cultural Properties. There is a high potential for the discovery of sacred sites and sites of interest to modern Native Americans. These will likely be rock alignments, burials, traditional use areas, and areas or locales that are identified during Native American consultation.

BLM engages in ongoing proactive consultation with affected Native Americans, in particular the Eastern Band of the Shoshone, concerning the identification and management of cultural resources (BLM, 1999a and 2003a). In 2004, consultation with the Shoshone Tribe resulted in a set of tribal guidelines for buffer zones for development near Native American sites. These guidelines, dictated from tribal elder Richard Ferris, Sr., are frequently used by BLM but stand as non-binding recommendations:

For seismic activity:

simple cairns that are stable and embedded in the soil: 300 feet is sufficient to protect these sites;

standing cairns: distance for protection will be decided upon on a case-by-case basis;

medicine wheels: case-by-case basis, 0.25 mile should be considered standard;

rock art: 0.25 mile minimum;

human burials and burial areas: 1 mile minimum, no exceptions;

fire pots: 300 feet;

receiver lines – rock art: 300 feet avoidance; and

receiver lines – complex cairns: can be laid carefully through sites, monitoring may be needed; no OHV use is permitted – foot traffic only.

For construction (well pads, roads, pipelines, etc.):

simple cairns that are stable and embedded in the soil: 0.25 mile;

standing cairns: 0.25 mile;

medicine wheels: 0.25 mile;

rock art: 0.25 mile;

human burials and burial areas: 1 mile minimum, no exceptions; and

fire pots: 0.25 mile.

For powerlines:

simple cairns that are stable and embedded in the soil: 300 feet or follow road if possible;

standing cairns: 300 feet or follow road if possible;

medicine wheels: 0.25 mile;

rock art: 0.25 mile;

human burials and burial areas: 1 mile minimum, no exceptions; and

fire pots: 300 feet.

General:

All other Tribal interests or sites and projects that are of concern to the Tribal interests can be considered on a case-by-case basis, by consultation. The Shoshone rely upon information provided to them by the BLM to determine sensitive sites, practicalities, and general project information. The Tribal recommendation is a visual inspection (on-site examination) for anything considered sensitive, not mentioned in the above guidelines. If a guideline as presented above proves not to be workable, individual consultation will be needed (Ferris, 2004).

Approximately 527 sites had been inventoried on over 5,320 acres in the PAPA prior to December 2005, and many additional sites have been inventoried since then (Vlcek, 2006 and Crume, 2006). Class III inventories were used during the investigations and are the current BLM standard. A Class III inventory is defined as a cultural resources inventory when 100 percent of the surface within the study area is surveyed using pedestrian inventory methods. It is likely that the PAPA contains many more cultural resources than those inventoried to date.

3.10.1.2 Unexpected Discoveries

Construction of access roads, well pads, pipelines, and other surface disturbances can produce unexpected cultural resource discoveries. During the first 5 years since issuance of the PAPA ROD (BLM, 2000b), there were 38 unexpected discoveries in the PAPA. Well pad and access road construction accounted for 23 discoveries, while pipeline construction resulted in 14. Some of these discoveries have been discussed in other parts of this section. Powerline construction resulted in one unexpected find (Crume, 2006). Unintentional damage occurs when development projects unexpectedly discover buried sites in sensitive archeological areas (BLM, 2003b).

3.10.1.3 Major Finds

During the first course of wellfield development in the PAPA, one especially sensitive archeological zone was revealed in the sandy bluffs on the south side of the New Fork River. Several discoveries in the sensitive zone were initially impacted by construction of well pads and other wellfield components. Sites found on the sandy bluffs overlooking the New Fork River have yielded abundant large mammal bones, lithic materials, and numerous features (firepits and component staining) indicative of prehistoric hunting and camping patterns. The extensive presence of the faunal materials suggests prehistoric exploitation of large game seasonal migrations in the area. Radio carbon dating of remains has documented use of the sandy bluffs during 5,000 to 7,000 years ago. A similar pattern of seasonal exploitation of large migratory game has been documented at the Trappers Point site (north of the PAPA) where a 6,000-year old pronghorn kill site has been excavated, a springtime exploitation coinciding with the seasonal movements of large game from Trappers Point to the New Fork River crossing.

The Mesa Breaks area is also an important sensitive location. A complicated, extensive discovery (over 70 features) was made on the SP 5-17 location. The SP 9-17 location had multiple discoveries, and also contains a rock alignment. In 2006, investigations ancillary to SP 3-28 and 7-28 locations (among others) identified complex archaeology, sensitive soils, and other cultural resources concerns (Vlcek, 2007).

3.10.1.4 Lander Trail SRMZ

The Oregon Trail system, in which the Lander Trail Cut-off is included, is eligible for National Register listing, and is part of the National Historic Trail system. The PAPA ROD (BLM, 2000b) established a 0.25-mile No Surface Occupancy zone from the Lander Trail within which BLM could prohibit construction activities on federally-administered public lands unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area (Map 3.10-1). This is consistent with the Pinedale RMP (BLM, 1988b) which authorized no surface disturbance to be allowed within 0.25 mile or the visual horizon (whichever is closer) of contributing segments of the historic trails. In the PAPA DEIS (BLM, 1999a), the 0.25-mile buffer and the viewshed (up to a distance of 3 miles on each side of the trail) of the Lander Trail were defined as the Lander Trail SRMZ, in which intrusions visible from approximately 3 miles of the trail's centerline could adversely affect its visual setting (Map 3.10-1). As originally conceived in the PAPA DEIS (BLM, 1999a), the Lander Trail SRMZ (Map 3.10-1) occupies approximately 22,900 acres or 12 percent of the PAPA (Table 3.10-1).

Map 3.10-1 Existing Wellfield Disturbance in Relation to the Lander Trail, Viewshed, Buffers, and Sensitive Resource Management Zone

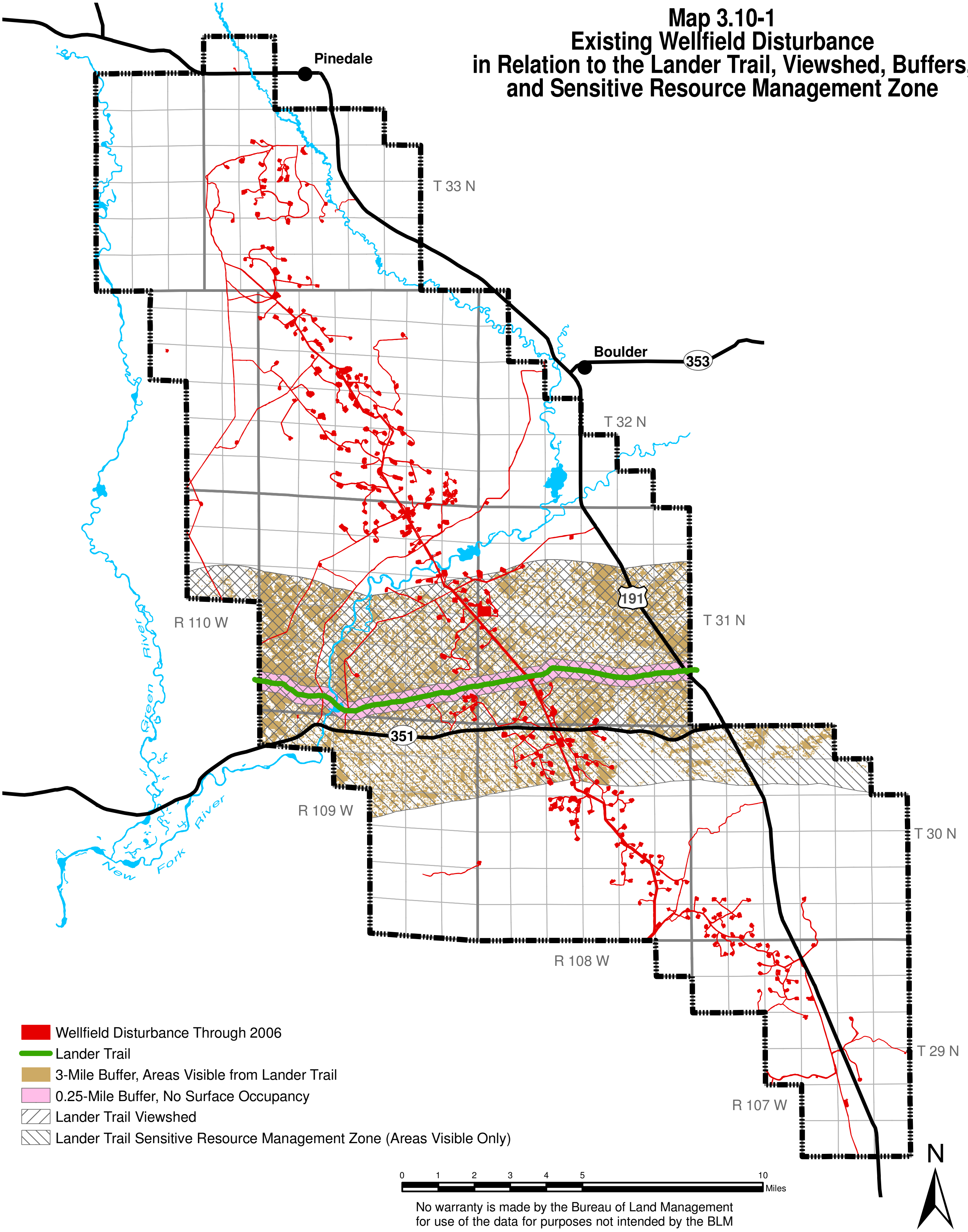


Table 3.10-1
Existing Wellfield Disturbance in Relation to the Lander Trail 0.25-Mile Buffer, SMRZ, and Viewshed

Lander Trail SRMZ Category	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Lander Trail 0.25-mile Buffer	3,978	41.2	8.6	49.8
Lander Trail SRMZ (PAPA DEIS)	22,893	412.6	43.2	455.8
Lander Trail Viewshed (PAPA ROD)	18,105	300.5	43.2	343.7

The concept of the Lander Trail SRMZ and Lander Trail viewshed were modified in the PAPA FEIS (BLM, 2000a) and PAPA ROD (BLM, 2000b) as both were incorporated into MA 1 for which the management objective is to preserve the integrity of the Lander Trail and Lander Trail Viewshed. The Lander Trail Viewshed was redefined in the PAPA ROD to include areas beyond the 0.25-mile protective buffer that would be visible up to 3 miles north of the trail and south of the trail to State Highway 351 (Map 3.10-1). To achieve this objective, BLM would require case-by-case visibility analyses to minimize visual intrusions by wellfield development to the greatest extent practicable. To that end, a pilot project was initiated in 2003 that identified ten Key Observation Points (KOPs) along 8 miles of the trail. In 2005, BLM and SHPO worked under an “Assistance Agreement” for the Lander Trail Viewshed Monitoring Project, budgeted through 2006, to include photography from each KOP. The photography was intended for future display and used to evaluate approaches to conceal wellfield developments (Vlcek, 2006 and Trautman, 2006).

As of November 2006, 455.8 acres had been disturbed within the Lander Trail SRMZ (defined in the PAPA DEIS) of which 49.8 acres were within the 0.25-mile buffer of the Lander Trail (Table 3.10-1). The disturbance includes well pads, roads (upgrading three collector roads: the Paradise Road, Boulder South Road, and Middle Crest Road), and pipelines. Through November 2006, 343.7 acres had been disturbed by wellfield activities within the Lander Trail Viewshed (defined in the PAPA ROD). Although the Lander Trail setting and viewshed have been compromised by these surface disturbances, intact portions of the trail are found immediately adjacent to the disturbances. In spring 2006, Nielson (formerly Petrogulf) constructed a well pad approximately 950 feet from the trail, altering characteristics of the trail on State of Wyoming land in Section 36, T. 31 N., R. 109 W. (Vlcek, 2006).

3.10.1.5 Programmatic Agreements

A segment of the Lander Trail is currently managed under a PA between the BLM, the Wyoming SHPO, the Advisory Council on Historic Preservation, the Oregon California Trails Association (OCTA), Shell, and Ultra, to mitigate proposed impacts to the Lander Trail’s setting, and to the extent possible, maintain the integrity of the trail (Appendix 15). Other parts of the PA require public education exhibits for the trail. These elements are currently being developed (Vlcek, 2006). The PA does not include other Operators who are developing near the Lander Trail and they are responsible for creating their individual mitigation or management plans.

The PAPA DEIS (BLM, 1999a) included the outline for a Jonah Field-Anticline-wide PA which was signed by the original PAPA Operators and resource management agencies. The PA required synthesis of archaeological data, development of a cultural resource management plan, and development of a treatment/mitigation plan for cultural resources in the PAPA, within 1 year of the signing of the PA and established deadlines for these documents. For various reasons, the Operators did not meet the deadlines set forth in the PA and it expired automatically (Vlcek, 2006).

In 2005, the Cultural/Historic Task Group of the PAWG researched the PAPA DEIS PA to assess the possibility of creating a new general PA for the PAPA. In cooperation with the BLM, the Task Group found that the revised Wyoming Protocol Agreement (Appendix 14), a document that describes how the Wyoming SHPO and the BLM will consult on cultural resource management (though not specific to the PAPA), was sufficient to protect resources in the PAPA. The Task Group determined that the Wyoming Protocol Agreement streamlines archeological resource management, but that a Memoranda of Agreement might be useful for continuing development of PAPA leaseholds (Vlcek, 2007).

Because there are several Operators in the PAPA, obtaining consensus on how to manage the extremely varied cultural resources has proven difficult (Vlcek, 2006). Further, the different geographic settings within the PAPA contain substantially different types of cultural resources. For example, the northern end of the Mesa and sensitive soils in the Mesa Breaks, which are identified in the PAPA DEIS, contain numerous Native American sites (BLM, 1999a). Cultural resources discovered near the New Fork River have been discussed, above. Leaseholds within the Blue Rim Area contain archeology and paleontological materials (Section 3.14, below). The south end of the PAPA is an area of complex archeological discoveries such as the New Fork House Pit site (48SU5084).

3.10.2 Pipeline Corridors and Gas Sales Pipelines

3.10.2.1 Cultural History Overview

Cultural resources in the areas crossed by the proposed corridor/pipeline alignments consist of sites from prehistoric and historic periods. The prehistoric period extends from approximately 12,000 years before present through 350 years before present, when Europeans began to arrive in the Green River Basin. Approximately 75 percent of the sites found in the Green River Basin are prehistoric. Artifacts from prehistoric times include projectile points, grinding slabs, pottery, and evidence of camp sites (BLM, 1997).

Historic trails to be crossed by the proposed corridor/pipeline alignments include the Oregon Trail, the Oregon Trail/Pony Express Route, the East Bank Kinney Cutoff, the Baker-Davis Road/Slate Creek Cutoff, the Sublette Cutoff, the Lander Cutoff, and the Opal Wagon Road.

3.10.2.2 Cultural Resource Inventory

Past and ongoing cultural resource inventories provide information on cultural resources present within the BCC, BFGC, and OPC (Stainbrook, 2006). Class I and III inventories for portions of the proposed BCC, BFGC, and OPC and adjacent lands, have been completed or are ongoing. The field survey of the R6 Pipeline is near completion. Eligibility testing for nomination to the NRHP has been initiated. Survey and testing of sites in temporary use areas is planned. The archaeological landscape, a secondary lithic procurement site, is documented along the proposed corridor/pipeline alignments. The landscape is not eligible for listing in NRHP.

Previously identified sites between the Pinedale/Gobblers Knob and Paradise compressor stations and the Bird Canyon Compressor Station include 17 not eligible, 10 eligible, and six unevaluated prehistoric camps; seven not eligible and four unevaluated lithic scatters, one not eligible historic road, one eligible prehistoric camp historic debris scatter, and one unevaluated lithic and historic debris scatter. Also documented is the Lander Cutoff of the Oregon Trail.

Previously identified sites located between the Bird Canyon Compressor Station and the Blacks Fork Processing Plant include one railroad, 17 eligible and 37 not eligible prehistoric camps, four not eligible prehistoric archaeological landscapes, one not eligible lithic scatter, and one not eligible can scatter. Not included in the above total are five not eligible prehistoric camps destroyed by past construction. Additionally, the Sevenmile Gulch Site (48SW1673) contains prehistoric housepits that were previously discovered in the corridor and are the subject of data recovery excavations. Similar highly significant housepits are likely to be impacted by future pipelines proposed in this corridor and would require mitigation through data recovery excavations. Also documented are the Oregon Trail, the Pony Express, the East Bank Kinney Cutoff, the Baker-Davis Road/Slate Creek Cutoff, and the Sublette Cutoff of the Oregon Trail.

Previously identified sites located between the Bird Canyon Compressor Station and Opal Gas Processing Plant include three eligible historic trails (Baker-Davis Road/Slate Creek Cutoff, the East Bank Kinney Cutoff, and the Sublette Cutoff), the non-contributing segments of the eligible Opal Wagon Road, one not eligible river crossing, one not eligible historic debris scatter, eight eligible and 32 not eligible prehistoric camps, three not eligible prehistoric camps with historic debris, six not eligible lithic scatters, and one not eligible lithic and historic debris scatter. Eight not eligible sites have been destroyed, including seven not eligible prehistoric camps and one not eligible cairn.

Additional field work conducted beyond the initial Class III survey would include staging areas located outside the pipeline survey and testing for eligibility for nomination to the NRHP. Not included in the above total are 15 not eligible prehistoric camps, five lithic scatters, and one historic debris site destroyed by past construction.

3.10.2.3 Native American Concerns

Native American tribes, including the Ute, Arapahoe, Shoshone, and Shoshone-Bannock, have had tribal territories located in the general area of the proposed corridor/pipeline alignments.

3.11 AIR QUALITY

3.11.1 Air Quality Monitoring Data

The affected environment described below for air quality includes a large portion of southwest Wyoming and surrounding areas. The discussion below is for proposed development within the PAPA and for the proposed construction of the natural gas pipelines.

3.11.1.1 Greenhouse Gases

Greenhouse gases including carbon dioxide (CO_2) and methane (CH_4), refer to the category of air emissions that have the potential to change the climate. These emissions are typically emitted from combustion activities or are directly emitted into the atmosphere. Currently, the WDEQ-AQD does not have regulations regarding greenhouse gas emissions, although these emissions are regulated indirectly by various other regulations for other pollutants.

3.11.1.2 Criteria Pollutants, Ambient Air Quality Standards, and PSD Increments

The Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based standards for the maximum concentration of air pollutants at all locations to which the public has access. Although specific air quality monitoring has not been conducted for the PAPA, air quality monitoring for the regional pollutants of concern has been determined to be representative of the PAPA. Measured air pollutants for which ambient air quality standards exist include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in effective diameter (PM_{10}), particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Monitored concentrations for these pollutants are compared to the WAAQS and NAAQS in Table 3.11-1. The PAPA is designated as attainment for all criteria pollutants.

Table 3.11-1
Air Pollutant Background Concentrations and
Wyoming and National Ambient Air Quality Standards ($\mu g/m^3$)

Pollutant	Monitoring Site	Averaging Time	Measured Background Concentration	Wyoming and National Ambient Air Quality Standards
Carbon monoxide (CO)	Yellowstone National Park [1]	1-hour	1,979	40,000
		8-hour	931	10,000
Nitrogen dioxide (NO_2)	Jonah Field [2] Boulder [3] Daniel [4]	Annual	19 [5] 8 [6] 6 [7]	100
Ozone (O_3)	Jonah Field [2] Boulder [3] Daniel [4]	8-hour [8]	142 [9] 148 [9] 137 [9]	157 [10]
Particulate matter (PM_{10})	Jonah Field [2] Boulder [3] Daniel [4]	24-hour [11]	51 [5] 32 [6] 23 [7]	150
	Jonah Field [2] Boulder [3] Daniel [4]	Annual	10 [5] 9 [6] 9 [7]	50 (WAAQS)
Particulate matter ($PM_{2.5}$)	Pinedale [12]	24-hour [11]	15	35 (NAAQS)[13] 65 (WAAQS)[14]
		Annual	6	15
Sulfur dioxide (SO_2)	Craven Creek [15]	3-hour	132	1,300
		24-hour	43	365 (NAAQS) 260 (WAAQS)
		Annual	9	80 (NAAQS) 60 (WAAQS)

[1] Background data collected during 2005 in Yellowstone National Park, Wyoming, monitoring site near “Old Faithful.” Monitoring site began operation during December 2002.
[2] Background data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Monitoring site began operation during November 2004.
[3] Background data collected approximately 5 miles southwest of Boulder, Sublette County, Wyoming. Monitoring site began operation during January 2005.
[4] Background data collected approximately 5 miles south of Daniel, Sublette County, Wyoming off Hwy. 18. Monitoring site began operation during July 2005.
[5] Values are based on a partial year of data (Jan 15, 2005 through Dec 31, 2005).
[6] Values are based on 1 year of data (April 2005 through March 2006).
[7] Values are based on 1 year of data (July 2005 through June 2006).
[8] Highest, fourth highest monitored value.
[9] Values are the 2 year average of the yearly fourth highest monitored 8-hour values collected during 2005 and 2006.
[10] Ambient Air Quality Standard is based on the 3 year average of the yearly fourth highest 8-hour concentrations. An area is in compliance with the standard if the fourth highest 8-hour ozone concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
[11] Highest, 98^{th} percentile monitored value.
[12] Background data collected in Pinedale, Wyoming. Values are based on 1 year of data collected during July 2005 through June 2006. Monitoring site began operation in July 2005.
[13] Revised NAAQS effective December 18, 2006. An area is in compliance with the standard if the 98^{th} percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
[14] EPA has revised the NAAQS effective December 18, 2006. The State of Wyoming will enter into rulemaking to revise the WAAQS.
[15] Background data collected at the LaBarge Study Area/Northwest Pipeline Craven Creek site which operated during 1982-1983.

Criteria pollutants have been monitored at several sites in Sublette County adjacent to the PAPA. The locations are within the Jonah Field, at the eastern edge of the PAPA near Boulder, and southwest of Pinedale near Daniel. The Boulder site has been in operation since January 2005, the Jonah Field site began operation in November 2004, and the Daniel site began operation in July 2005. The locations of these sites in relation to the PAPA are illustrated in Map 3.11-1. Background concentrations are used as an indicator of existing conditions in the region, and are assumed to include emissions from industrial sources in operation and from mobile, urban, biogenic, and other non-industrial emission sources. The Boulder site, which is at the eastern edge of the PAPA, is considered by the WDEQ-AQD as most representative of background conditions within the PAPA. The monitoring data available for all three Sublette County sites are provided in Table 3.11-1. The data collected at the Jonah Field and Daniel sites are provided for reference purposes. Monitored background values are in compliance with ambient air quality standards (Table 3.11-1), although concentrations equal to the level of the 8-hour ozone standard have been measured at the three Sublette County sites.

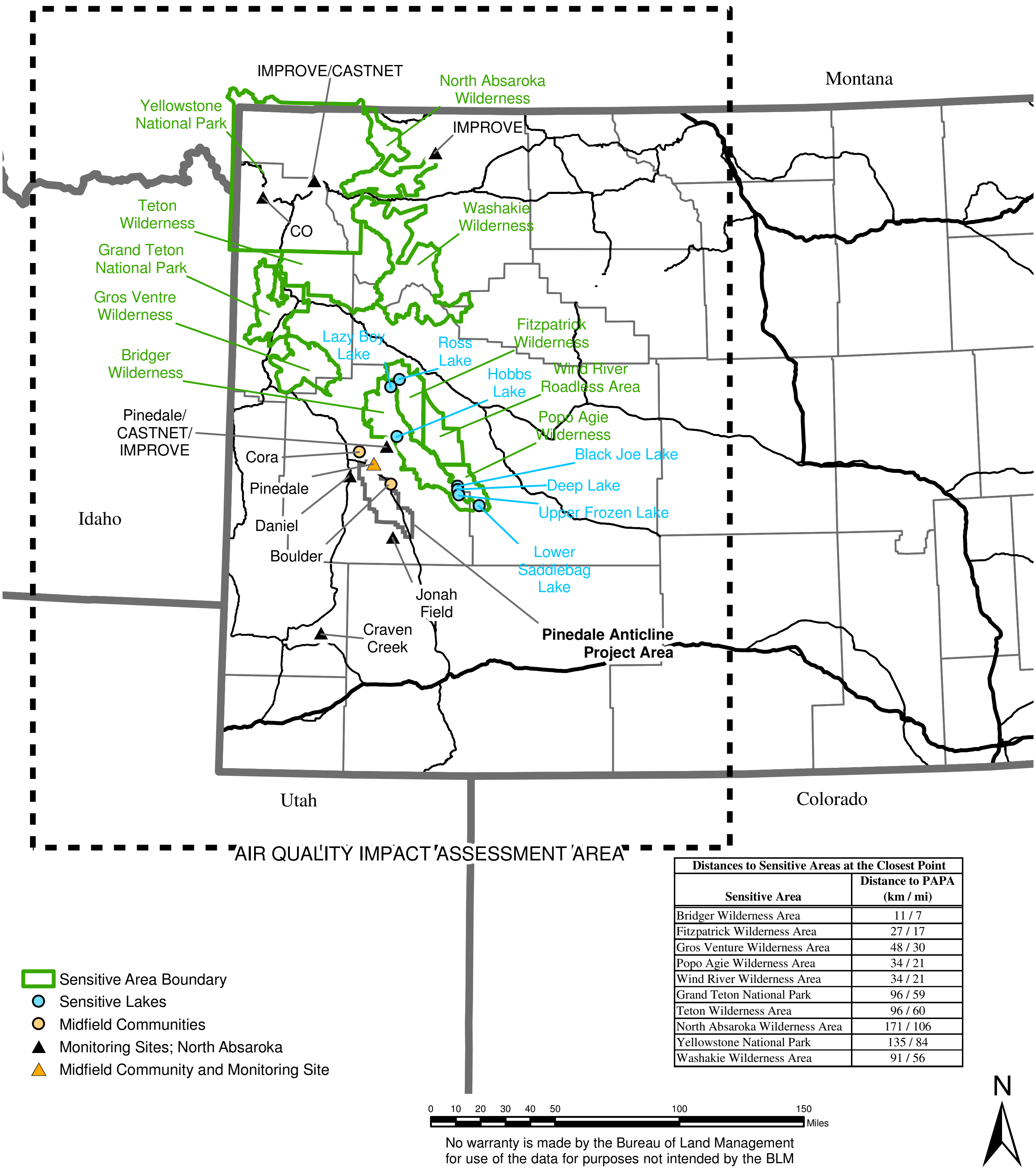
The federal ozone standard, promulgated by the EPA in 1997, is 0.08 ppm for 8 hours. Ozone is measured continuously, and running 8-hour averages are computed from hourly ozone concentrations. Each of the 8-hour averages is assigned to the first hour of the 8-hour period. For example, an 8-hour average calculated from data collected during the 8-hour period starting at 12 p.m. is assigned to 12 p.m. With complete data, there are 24 8-hour average concentrations calculated for each day. The highest of these daily 8-hour averages is identified as the maximum 8-hour concentration for the day (EPA, 1998).

Compliance with the NAAQS and WAAQS standard is determined from analysis of monitoring data collected over three consecutive years. The highest 8-hour values over each year are obtained and the fourth highest values for each of the 3 years are averaged. An area is in compliance with the NAAQS and WAAQS for ozone if this average is equal to or less than 0.08 parts per million (ppm) or 157 micrograms per cubic meter (µg/m3). Even though the air quality standard (NAAQS and WAAQS) for ozone is 0.08 ppm, an exceedance of the standard would not occur until the 4th highest 8-hour concentration averaged over 3 years is 0.085 ppm or above for the monitored values (due to rounding, see 40 CFR §50.10 and Appendix 16).

The Sublette County ambient air monitoring stations recorded elevated ozone levels during their first 2 years of operation (2005 and 2006). The average of the fourth highest 8-hour values measured over 2005 and 2006 are shown in Table 3.11-1. The four highest 8-hour values for each year are shown in Table 3.11-2. The elevated ozone levels have been recorded during the winter months, primarily in the month of February, which is atypical when compared to other areas of the country where ozone levels are elevated. Typically, ozone is thought to be a summertime problem in urban areas. Elevated ozone concentrations are uncommon during the winter months; however, they do not appear to be an anomaly because these conditions were recorded in both February 2005 and February 2006. There are several hypotheses on the cause(s) of these elevated ozone events including stratospheric ozone intrusion, ozone transport from other areas, unique meteorological conditions acting upon local scale emissions, and instrument error.

These hypotheses have been explored through evaluations of recorded conditions of meteorological data and air pollutant data, both locally and regionally. The evaluations have resulted in the WDEQ-AQD concern that elevated ozone concentrations monitored in the winters of 2005 and 2006 are a result of ground-level ozone formation. The WDEQ-AQD and EPA are concerned that unique wintertime meteorological conditions acting upon local scale emissions may be contributing to ozone formation. The WDEQ-AQD has initiated further evaluation of ozone formation in the Upper Green River Basin through a field study and

Map 3.11-1
Air Quality Impact Assessment Area Showing Locations of Sensitive Areas, Midfield Communities, and Monitoring Sites



Distances to Sensitive Areas at the Closest Point	
Sensitive Area	Distance to PAPA (km / mi)
Bridger Wilderness Area	11 / 7
Fitzpatrick Wilderness Area	27 / 17
Gros Venture Wilderness Area	48 / 30
Popo Agie Wilderness Area	34 / 21
Wind River Wilderness Area	34 / 21
Grand Teton National Park	96 / 59
Teton Wilderness Area	96 / 60
North Absaroka Wilderness Area	171 / 106
Yellowstone National Park	135 / 84
Washakie Wilderness Area	91 / 56

Table 3.11-2
Maximum Monitored 8-hour Ozone Concentrations for 2005 and 2006

Monitor	Rank	Ozone Concentration (ppm)	
		2005	2006
Jonah Field	1st	0.098	0.093
	2nd	0.089	0.071
	3rd	0.078	0.069
	4th	0.076	0.069
Boulder	1st	0.088	0.081
	2nd	0.081	0.079
	3rd	0.080	0.076
	4th	0.079	0.072
Daniel	1st	0.070	0.082
	2nd	0.066	0.075
	3rd	0.066	0.074
	4th	0.066	0.074

modeling project to better understand the cause of these monitored elevated ozone levels. These efforts are currently being conducted by the WDEQ-AQD and will likely be completed within the next 2 years. The results of those efforts will form the basis for WDEQ-AQD to develop strategies to manage ozone formation in the Upper Green River Basin to ensure that the area remains in compliance with air quality standards (WAAQS and NAAQS).

Federal air quality regulations adopted and enforced by WDEQ-AQD limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. PSD Increments are defined for NO_2, SO_2, and PM_{10}. The incremental increase depends on an area's classification. Seven PSD Class I areas are identified as sensitive areas in the modeling domain: the Bridger, Fitzpatrick, North Absaroka, Teton, and Washakie wilderness areas, and Grand Teton and Yellowstone national parks (see Map 3.11-1). Strict limitations on the additional amount of air pollution in PSD Class I areas, associated with major emitting facilities, are applied. The remainder of the modeling domain is classified PSD Class II, where similar but less stringent incremental air quality limits apply. The Gros Ventre and Popo Agie wilderness areas and the Wind River Roadless Area are PSD Class II areas that have been identified as additional sensitive areas occurring within the modeling domain for air quality. PSD Class I and sensitive PSD Class II areas are shown on Map 3.11-1 as sensitive areas. The PSD Class I and Class II Increments are provided in Table 3.11-3.

Table 3.11-3
Prevention of Significant Deterioration (PSD) Increments (μg/m^3)

Pollutant	Averaging Time	Incremental Increase Above Legal Baseline	
		PSD Class I	PSD Class II
Nitrogen dioxide (NO_2)	Annual	2.5	25
	3-hour	25	512
Sulfur dioxide (SO_2)	24-hour	5	91
	Annual	2	20
Particulate matter (PM_{10})	24-hour	8	30
	Annual	4	17

3.11.1.3 Air Quality Related Values

Visibility

The 1977 Clean Air Act amendments established visibility as an AQRV that federal land managers must consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I areas. Residents of the Pinedale area consider visibility impairment to be a major concern.

There are two types of visibility impairment caused by emission sources: plume impairment and regional haze. Plume impairment occurs when a section of the atmosphere becomes visible due to the contrast or color difference between a discrete pollutant plume and a viewed background such as a landscape feature. Regional haze occurs when pollutants from diffuse emission sources mix in the atmosphere, causing a general alteration in the appearance of landscape features, changing the color or contrast between landscape features, or causing features of a view to disappear. Regional haze is caused by light scattering and light absorption by fine particles and gases.

Visibility impairment is measured in terms of change in light extinction or change in deciview (dv). Potential changes to regional haze are calculated in terms of a perceptible ("just noticeable") change in visibility when compared to background conditions. A dv change of 1.0 or 2.0 (equivalent to a 10 percent and 20 percent change in extinction) represents a small but perceptible change in visibility. The BLM considers a 1.0 dv change to be a significance threshold for visibility impairment, although there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies use a 0.5 dv change as a screening threshold for significance.

Visual range, referred to as standard visual range (SVR), is the farthest distance at which an observer can see a black object viewed against the horizon sky; the larger the SVR, the cleaner the air. Visibility conditions can be measured in SVRs (miles). Visibility within the PAPA air quality modeling domain is considered very good, with an average SVR of over 93.2 miles (Malm, 2000).

Visibility is monitored within PSD Class I areas. In 1985, the Interagency Monitoring of Protected Visual Environments (IMPROVE, 2006) monitoring program was initiated to establish current visibility conditions, to track visibility changes, to establish long-term trends, and to determine the causes of visibility impairment in PSD Class I areas. The IMPROVE sites closest to the PAPA include the Bridger Wilderness Area, North Absaroka Wilderness Area, and Yellowstone National Park IMPROVE sites. Data have been collected near the Bridger Wilderness Area and Yellowstone National Park sites since 1989 and at the North Absaroka Wilderness Area since 2002. Figures 3.11-1, 3.11-2, and 3.11-3 show SVRs at the IMPROVE sites for the cleanest days (20th percentile best visibility days); for 20th percentile middle conditions; and for the haziest days (20th percentile haziest visibility days), respectively (IMPROVE, 2006). SVRs were reconstructed from monitored aerosol (suspended liquid or solid particles) data.

Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and it is reported as the mass of material deposited on an area per year in kilograms per hectare-year (kg/ha-yr). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of pollutants). The chemical components of wet deposition include sulfate (SO_4), nitrate

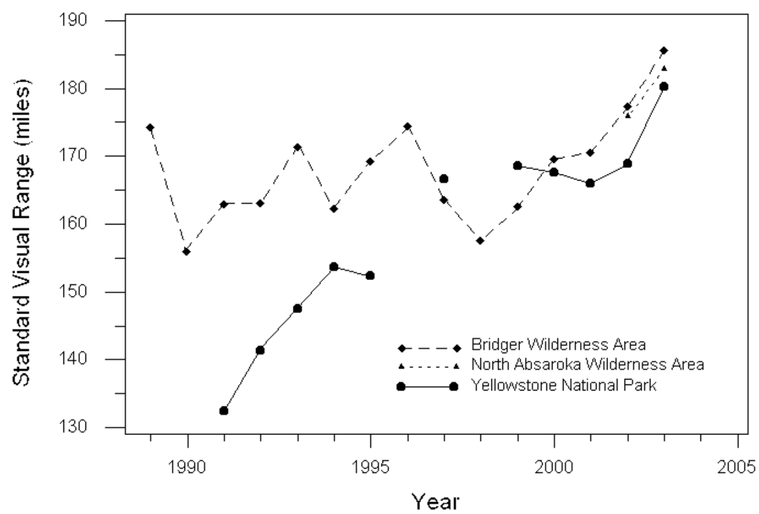


Figure 3.11-1
Standard Visual Range (SVR) for 20th % Cleanest Days, Pinedale Anticline Project Area, Sublette County, Wyoming
(Source: IMPROVE, 2006)

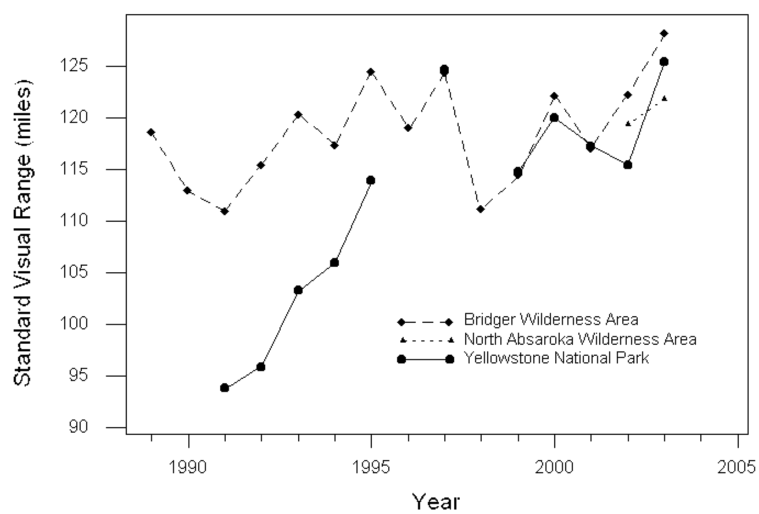


Figure 3.11-2
Standard Visual Range (SVR) for 20th % Middle Days, Pinedale Anticline Project Area, Sublette County, Wyoming
(Source: IMPROVE, 2006)

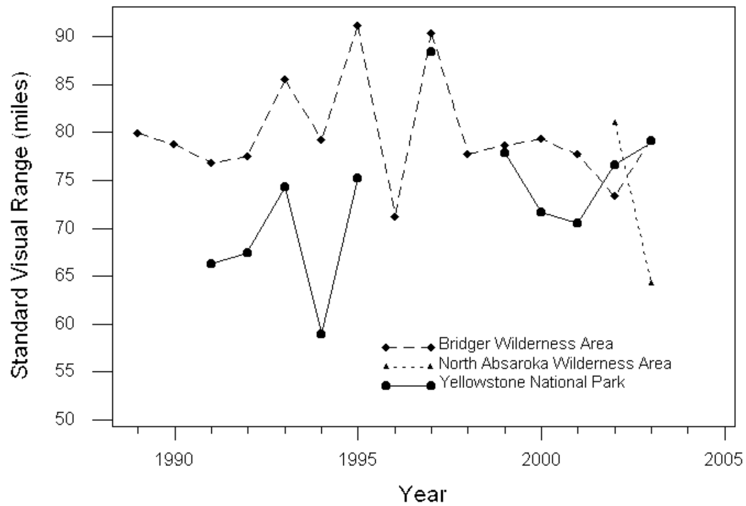


Figure 3.11-3
Standard Visual Range (SVR) for 20th % Haziest Days, Pinedale Anticline Project Area, Sublette County, Wyoming
(Source: IMPROVE, 2006)

(NO_3), and ammonium (NH_4). The chemical components of dry deposition include SO_4, SO_2, NO_3, NH_4, and nitric acid (HNO_3). Near Pinedale, the National Acid Deposition Program (NADP) and National Trends Network (NTN) station monitors wet atmospheric deposition and the Clean Air Status and Trends Network (CASTNET) station monitors dry atmospheric deposition. Figures 3.11-4 and 3.11-5 show the total annual background deposition (wet and dry) reported as total nitrogen (N) and total sulfur (S) deposition for these sites for the monitoring period of record through 2004. These figures show the contribution of each measured chemical component to the total deposition values.

Total deposition levels of concern (LOC) have been established for several areas, including the Bridger Wilderness Area (USFS, 1989). The “red line” LOC represents an estimate of the total pollutant loadings that each wilderness can tolerate. If an analysis done under the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) guidelines indicates total loadings above these values, it may suggest that the land manager recommend a reduction of emissions from new sources unless data are available to indicate that no AQRVs in the PSD Class I area are likely to be adversely affected. The “green line” LOC represents the total pollution loadings (current plus proposed new source contribution) below which a land manager can recommend that a permit be issued for a new source, unless data are available that indicate otherwise. The USFS has indicated that the current green line values are set too high and do not adequately protect ecosystems from nitrogen and sulfur deposition (Svalberg, 2006). Cumulative impacts plus background are compared to these LOCs. The Bridger Wilderness sulfur deposition red line LOC is 20 kg/ha-yr and sulfur deposition green line is 5 kg/ha-yr. The Bridger Wilderness nitrogen deposition red line LOC is 10 kg/ha-yr and nitrogen deposition green line LOC is 3-5 kg/ha-yr. The Bridger Wilderness LOCs are shown on Figures 3.11-4 and 3.11-5 to facilitate comparison with reported values from the Pinedale stations.

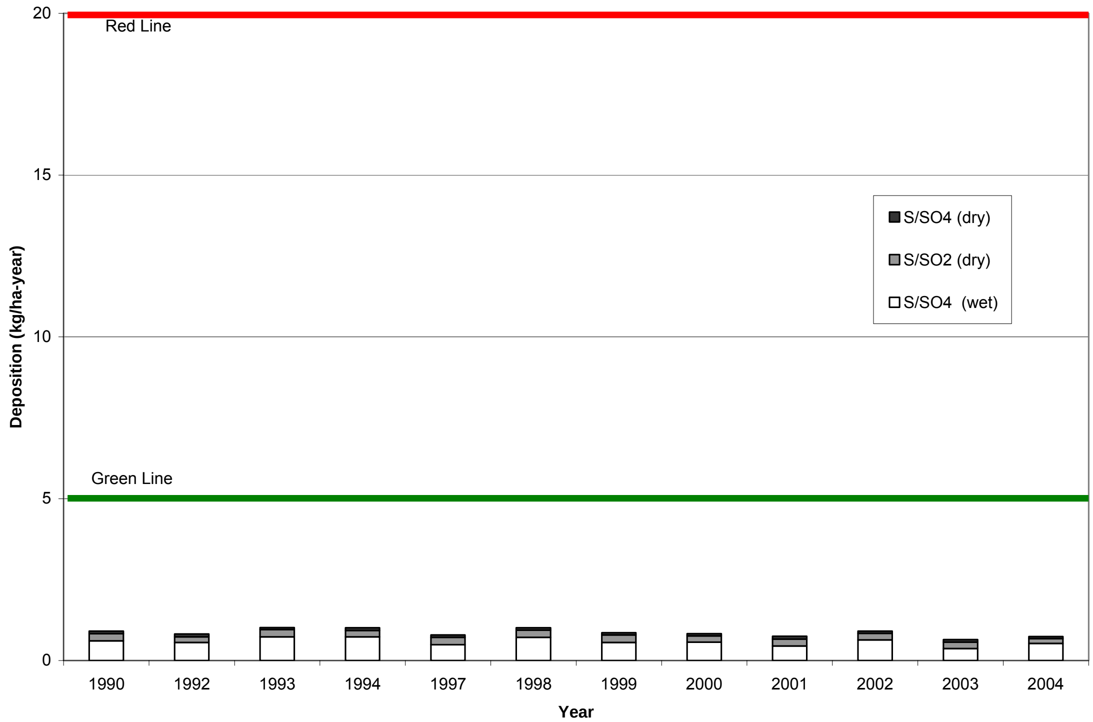


Figure 3.11-4
Mean Annual Total Sulfur Deposition near Pinedale, Wyoming

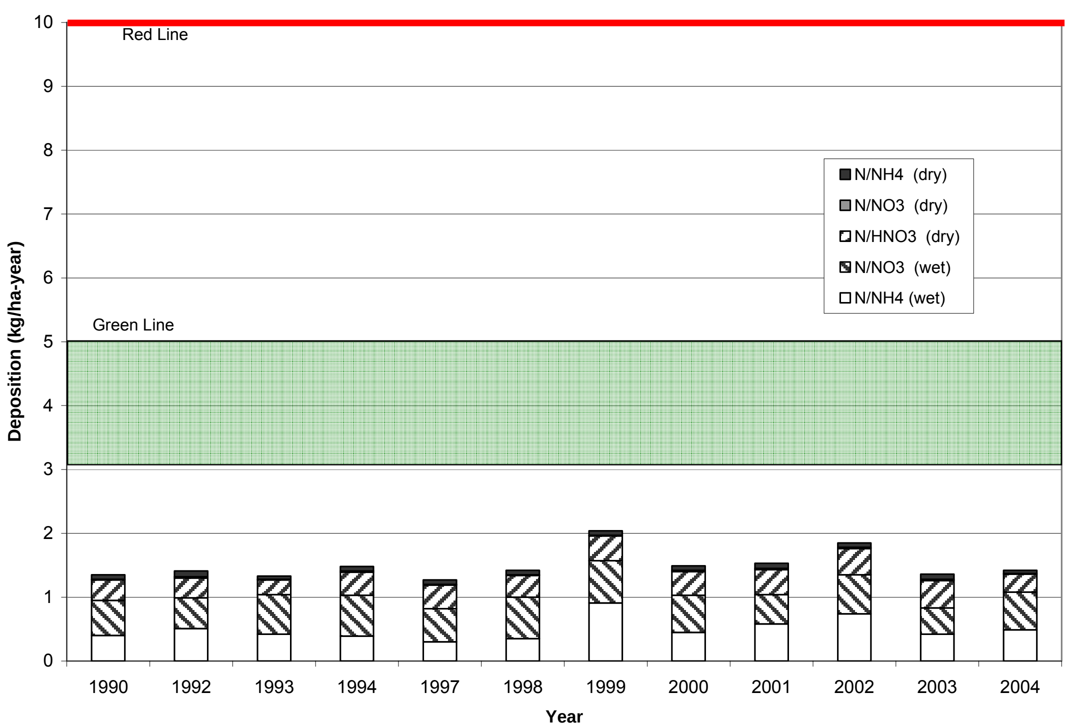


Figure 3.11-5
Mean Annual Total Nitrogen Deposition near Pinedale, Wyoming

The USFS collected site-specific lake chemistry background data (pH, acid neutralizing capacity - ANC, elemental concentrations, etc.) in several high mountain lakes in wilderness areas near the PAPA. Lakes considered sensitive to acid deposition for which background data were collected are shown on Map 3.11-1. Lake acidification is measured in terms of change in ANC, which is the lake's buffering capacity to resist acidification from atmospheric deposition of acid compounds such as sulfates and nitrates. Measured background ANC data for acid-sensitive lakes within the modeling domain are provided in Table 3.11-4.

Table 3.11-4
Monitored Background Conditions at Acid-Sensitive Lakes[1]

Sensitive Lake	Lake Location	Background ANC (μeq/l)[2]	Number of Samples	Period of Monitoring
Black Joe Lake	Bridger Wilderness Area	67.1	67	1984-2005
Deep Lake	Bridger Wilderness Area	59.7	64	1984-2005
Hobbs Lake	Bridger Wilderness Area	69.9	71	1984-2005
Lazy Boy Lake	Bridger Wilderness Area	10.8	3	1997-2004
Upper Frozen Lake	Bridger Wilderness Area	6.0	8	1997-2005
Ross Lake	Fitzpatrick Wilderness Area	53.7	49	1988-2005
Lower Saddlebag Lake	Popo Agie Wilderness Area	55.2	48	1989-2005

[1] Source: USFS, 2006.
[2] 10th percentile lowest ANC values reported.

The USFS considers lakes with ANC values greater than 25 microequivalents per liter (μeq/l) to be sensitive to atmospheric deposition and lakes with ANC values less than or equal to 25 μeq/l to be extremely sensitive to atmospheric deposition. Of the seven lakes identified by the USFS as acid-sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid-sensitive.

The USFS has identified a specific methodology to determine acceptable changes in ANC, which are used to evaluate potential air quality impacts from deposition at acid-sensitive lakes (USFS, 2000). The USFS has established a level of acceptable change (LAC) of no greater than a 1 μeq/l change in ANC (from human causes) for lakes with existing ANC levels less than or equal to 25 μeq/l. The USFS adopted a limit of 10 percent change in ANC reduction for lakes with an ANC greater than 25 μeq/l.

3.11.2 Impacts to Air Quality from Existing Wellfield Activities

Potential impacts to air quality resulting from exploration and development of natural gas in the PAPA were previously analyzed in the PAPA DEIS (BLM, 1999a). Since issuance of the PAPA ROD (BLM, 2000b), natural gas development in the PAPA has occurred at a pace greater than that analyzed in the PAPA DEIS. The PAPA ROD authorized the development of 700 producing wells or well pads (Chapter 1, Section 1.3) and set thresholds of 376.59 tpy of NO_x emissions from compression, and 693.5 tpy of NO_x emissions from all sources in the field. The air quality impact analysis conducted in the PAPA DEIS assumed 700 producing wells and up to eight drilling rigs operating in the PAPA at any one time. As of December 2005, there were approximately 457 producing wells and over 26 drilling rigs operating in the PAPA. However, 29 of the producing wells were drilled prior to the PAPA ROD. The NO_x emissions from all sources operating in the PAPA during year-2005 were estimated at 3,512.4 tpy which exceeds the 693.5 tpy analysis threshold specified in the PAPA ROD (BLM, 2000b).

Many of the air quality monitoring data presented in Section 3.11.1 are representative of year-2005, and therefore, include some level of pollutant impacts resulting from wellfield activities that occurred in the PAPA during 2005. However, air quality impact analysis modeling has not been performed for the current level of development. Due to concerns that the monitoring network may not be sufficient for quantifying the maximum impacts that occur from the PAPA, modeling has been performed to estimate the air quality impacts of the year-2005 for PAPA wellfield activities. This analysis was performed primarily to estimate impacts to visibility (regional haze), atmospheric deposition, and ambient concentrations of NO_2, SO_2, PM_{10}, and $PM_{2.5}$. These are the AQRVs and ambient concentrations for which recent monitoring data near the PAPA are available.

An inventory of criteria pollutant and hazardous air pollutant (HAP) emissions from construction (due to potential surface disturbance by earthmoving equipment, vehicle traffic, fugitive dust, well completion and testing, and drilling rig and vehicle engine exhaust), production (production equipment, compression engine exhausts, vehicle traffic engine exhausts, and fugitive dust), and other ancillary facilities was developed for year-2005. The inventory was developed based on documented operating parameters, statistics and emission estimates for oil and gas activities in the PAPA for year-2005, and is intended to provide a summary of "actual" emissions that were emitted during 2005 in the PAPA. Criteria pollutant emissions include NO_x, CO, SO_2, volatile organic compounds (VOCs), PM_{10}, and $PM_{2.5}$. HAPs consist of n-hexane, benzene, toluene, ethylbenzene, and xylene (BTEX) and formaldehyde. Total criteria pollutant and HAP emissions from the PAPA for year-2005 are summarized in Table 3.11-5. Although emissions are quantified for all criteria pollutants and HAPs, the year-2005 modeling analysis of project emissions was only performed for NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions. NO_x, SO_2, and PM_{10}/$PM_{2.5}$ emissions are precursors to regional haze formation, whereas NO_x, and SO_2 emissions impact acid deposition. Detailed information regarding the 2005 emission inventory and the air quality impact analyses are provided in the Air Quality Impact Analysis Technical Support Document (Air Quality TSD).

Table 3.11-5
Pinedale Anticline Project Pollutant Emissions for Year-2005

Pollutant	Summer (lb/hour)	Winter (lb/hour)	Total (tpy)
Nitrogen oxides (NO_x)	863.1	798.4	3,512.4
Sulfur dioxide (SO_2)	54.4	53.0	231.8
Carbon monoxide (CO)	723.9	624.7	2,745.7
Volatile Organic Compounds (VOCs)	580.7	568.9	2,494.3
Particulate matter (PM_{10})	532.0	145.3	1,199.0
Particulate matter ($PM_{2.5}$)	156.7	64.3	401.4
Formaldehyde	9.5	9.5	41.7
Benzene	16.6	16.6	72.7
Toluene	28.6	28.6	125.4
Ethylbenzene	8.5	8.5	37.1
Xylene	18.0	18.0	78.9
n-Hexane	8.8	8.8	38.5

The year-2005 air quality analysis utilized the 2005 PAPA emissions and the EPA CALMET/CALPUFF modeling system to predict maximum potential air quality impacts at mandatory federal PSD Class I and other sensitive PSD Class II areas (far-field locations), as well as at designated acid-sensitive lakes in these areas. The analysis includes an assessment of impacts at mid-field locations (regional communities of Boulder, Cora, and Pinedale), and at in-field locations within the PAPA. The analyzed areas are shown on Map 3.11-1.

For this analysis, 3 years (2001, 2002, and 2003) of hourly windfields were developed with the CALMET meteorological model for the modeling domain (Map 3.11-1). The CALPUFF dispersion model was used to model estimated NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions for each year of meteorology to estimate maximum potential in-field (within the PAPA) ambient air pollutant concentrations, as well as maximum ambient air pollutant concentrations, visibility (regional haze), and atmospheric deposition impacts at the sensitive (far-field) PSD Class I and

Class II areas. Maximum visibility impacts were also determined for the (mid-field) regional communities of Boulder, Cora, and Pinedale. Detailed information regarding the modeling methodologies used in the analysis is provided in the Air Quality TSD.

Predicted pollutant concentrations were compared to applicable ambient air quality standards and to PSD Class I and Class II increments, and were used to assess potential impacts to visibility (regional haze) at PSD Class I and sensitive PSD Class II areas. Ambient background concentrations were added to modeled concentrations for comparison to ambient air quality standards. Ambient background concentrations were not added to modeled concentrations for comparison to PSD Class I and II Increments. All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD increment consumption analysis.

Predicted changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled concentration impacts to background visibility conditions representative of each PSD Class I or sensitive PSD Class II area. At the request of the BLM, WDEQ-AQD, and USFS, three separate methods were performed using two different representations of background visibility conditions. Two additional visibility methods that follow recent CALPUFF modeling guidance for Best Available Retrofit Technology (BART) analyses developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization (RPO) were also performed (VISTAS, 2006).

The BLM and USFS methods use visibility values provided in the FLAG Report for each Class I area to represent natural background visibility. The WDEQ-AQD method uses representative monitoring data, for the quarterly average of the 20 percent best visibility days that were collected from the IMPROVE network for the time period that coincides with the period used to establish "baseline conditions" under the EPA Regional Haze Rule (2000 to 2004) (EPA, 2003a). The two BART methods use background visibility conditions representative of each Class I area as provided in the Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule (EPA, 2003b).

Visibility impacts for the BLM method are presented herein compared to the BLM 1.0 dv change threshold. All other visibility impact analyses and comparisons are detailed and presented in the Air Quality TSD.

Changes in regional haze at the Wyoming regional community locations (Boulder, Cora, and Pinedale) were predicted using CALPUFF modeled impacts and recent (year 2005-2006) background visibility data collected at Boulder. Visibility impacts were compared to the BLM 1.0 dv change threshold. Visibility impacts in regional community locations are not regulated by state or federal agencies.

Impacts to nitrogen and sulfur deposition at PSD Class I and sensitive PSD Class II areas were predicted by CALPUFF and were added to background nitrogen and sulfur deposition values for comparison with total deposition LOC. The predicted nitrogen and sulfur deposition values at acid-sensitive lakes were used to estimate change in ANC for comparison with the LAC.

Table 3.11-6 presents a summary of maximum predicted impacts to air quality from wellfield development in the PAPA in 2005. The modeled impact values are provided in Appendix 16, Tables 16.1 through 16.13. The summary shown in Table 3.11-6 and the predicted impacts provided in Appendix 16 represent maximum CALPUFF modeled impacts that were predicted using 3 years (2001-2003) of CALMET meteorological data.

Table 3.11-6
Summary of 2005 Air Quality Impacts from Wellfield Development in the PAPA

Air Quality Measure	Predicted Impact Summary
Concentrations of NO_2, SO_2, PM_{10}, and $PM_{2.5}$	Predicted concentrations are in compliance with applicable NAAQS and WAAQS at all locations; predicted near-field concentrations of PM_{10} are above the PSD 24-hour PM_{10} increment, annual PM_{10} increment, and the NO_2 increment; and below the PSD increments for SO_2; predicted far-field concentrations are below PSD increments.[1]
Visibility (regional haze) at PSD Class I and sensitive PSD Class II areas (far-field)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 45 days per year at the Bridger Wilderness, 5 days at the Fitzpatrick Wilderness, 1 day at Grand Teton National Park, 2 days at the Gros Ventre Wilderness, 6 days at the Popo Agie Wilderness, 6 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas.
Visibility (regional haze) (mid-field communities)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 108 days per year at Boulder, 36 days at Cora, and 55 days at Pinedale.
Atmospheric/terrestrial deposition	Predicted Impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas.
Sensitive lake ANC	Predicted impacts are less than the LAC at all acid-sensitive lakes.

[1] All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.

3.12 NOISE

Noise measurements taken at several locations across the PAPA prior to issuance of the PAPA ROD (BLM, 2000b) indicate that background noise is similar to EPA's category of "Farm in Valley" (EPA, 1971). The background noise levels (decibels on the A-weighted scale or dBA) for the Farm in Valley category are: daytime (39 dBA); evening (39 dBA); and nighttime (32 dBA). Local conditions such as traffic, topography, and high winds characteristic of the region can alter background noise conditions. The PAPA DEIS (BLM, 1999a) identified the following areas as being noise-sensitive: greater sage-grouse leks, crucial big game habitat during critical periods, residences within and adjacent to the PAPA, areas adjacent to the Lander Trail, ranches along both the New Fork and Green rivers, occupied raptor nest sites, and recreation areas. The PAPA ROD set noise limits on wellfield development, specifically compressor sites and "other long-term" facilities, so that distance to a dwelling or a greater sage-grouse lek would be sufficient to result in no noise level increase at the dwelling and would not result in a noise level increase greater than 10 dBA above background at the edge of a greater sage-grouse lek.

Appendix A in the Decision Record for the ASU Year-Round Drilling Demonstration Project (BLM, 2005b) set a performance-based objective for the ASU Operators to "maintain noise levels at 75 dBA or less measured 30 feet from the noise source (drilling rig, compressor, etc.)." Winter drilling was allowed under the Decision Record, and Ultra and Shell monitored noise levels. Noise was measured at each of the four principal compass points at 35 feet from the edge of each of three well pads subject to winter drilling over a 5 to 8 day monitoring period. Noise measurements included total noise from drilling by two drilling rigs per well pad, as well as noise generated by other activities associated with drilling (tripping pipe, short-tripping at casing depth, running casing, cementing, and circulating) and other equipment entering and operating on pads (high vacuum trucks, cement trucks, mud transport trucks, wireline trucks, backhoes, front-end loaders, rigging trucks, process cuttings equipment, air compressor blow down, general truck traffic with engine breaking, pipe inspection equipment, welding equipment, and grinding equipment). Because the noise monitors were located 35 feet from the edge of the well pads, it not possible to separate noise generated by drilling from noise generated by other sources.

Although the noise monitoring stations were located 35 feet from the edge of each well pad, they were much farther from the actual noise sources. The distance from the noise monitoring stations to the drilling rig engines, which produce the most consistent noise, varied from 184 feet to 811 feet (Table 3.12-1).

Table 3.12-1
Noise Measurements at Three ASU Well Pads
with Winter Drilling by Two Rigs per Pad During Winter 2006[1]

Well Pad	Measured at North Monitoring Point		Measured at South Monitoring Point		Measured at East Monitoring Point		Measured at West Monitoring Point	
	Average Noise (dBA)	Distance to nearest Engine (feet) [2]	Average Noise (dBA)	Distance to nearest Engine [2] (feet)	Average Noise (dBA)	Distance to nearest Engine [2] (feet)	Average Noise (dBA)	Distance to nearest Engines [2] (feet)
Ultra Mesa 7-34	57.2	346	62.9	237	58.4	184	54.7	811t
Ultra Mesa 9C-35D [3]	62.2	337	69.9	255	65.8	262	64.4	255
Shell Mesa 7-29	55.4	340	58.5	356	53.7	364	55.2	308

[1] ENSR, 2006a, 2006b, and 2006c.
[2] Distance from the noise monitoring point to the nearest drill rig engine was measured from scaled well pad plot plans.
[3] Engine locations were not shown on Ultra's Mesa 9C-35D pad; distance was measured to each rig location.

Distances to noise monitoring stations and the associated average noise at each monitoring station in Table 3.12-1 can be used to estimate the distance from the drilling rig engines at which the engine noise would attenuate to EPA's Farm in Valley background level of 39 dBA. Assuming that only one engine assembly generated noise on a well pad and that noise was attenuated by 6 dBA for every doubling of distance from the source, the distances at which engine noise would approximate background noise would range from 1,717 feet to 8,944 feet (Table 3.12-2). With the same assumptions, the distances at which engine noise would attenuate to 49 dBA (10 dBA above background) at noise-sensitive sites defined in the PAPA ROD (dwellings, greater sage-grouse leks) range from 543 feet to 2,828 feet.

Table 3.12-2
Distances Noise Would Attenuate to Background (39 dBA) and PAPA
ROD Limits at Noise-Sensitive Locations (49 dBA) from ASU Drilling Rigs

Well Pad	Attenuation Distance from North Monitoring Point (feet)		Attenuation Distance from South Monitoring Point (feet)		Attenuation Distance from East Monitoring Point (feet)		Attenuation Distance from West Monitoring Point (feet)	
	39 dBA	49 dBA	39 dBA	49 dBA	39 dBA	49 dBA	39 dBA	49 dBA
Ultra Mesa 7-34	2,812	889	3,713	1,174	1,717	543	4,943	1,563
Ultra Mesa 9C-35D	4,871	1,540	8,944	2,828	5,732	1,813	4,748	1,502
Shell Mesa 7-29	2,246	710	3,361	1,063	1,977	625	1,989	629

Questar conducted noise monitoring at one well pad where completion operations, plug-drilling, and down-rigging occurred during December 2005. Noise from operations was combined with noise from vehicle traffic, wind, and noise from operations on other nearby pads. The study concluded that the highest noise was associated with completion operations; however, well completion also coincided with the highest traffic volume (15 vehicles per hour entering or leaving the pad) and the highest winds during the monitoring period (TRC Mariah Associates, Inc., 2006).

In the Jonah Infill Drilling Project Area, well testing (fracturing and flaring) operations were reported to produce noise levels up to 115 dBA, attenuating to 55 dBA at 3,500 feet (BLM, 2006c). Flaring (one component of completion operations) tended to be the loudest noise event. Using flowback separators reduced noise from completion operations to approximately 64 dBA at the source. Noise levels at the Falcon Compressor Station in the south of the PAPA are about 77 dBA near the compressor station and about 65 dBA about 1.0 mile to the east (BLM, 2006c).

3.13 GEOLOGY, MINERALS, AND GEOLOGIC HAZARDS

3.13.1 Development in the PAPA

3.13.1.1 Geology

The PAPA is located on a northwesterly to southeasterly plunging anticlinal ridge within the Green River Basin Geologic Province. The anticline trends parallel to the Wind River Range in the north of the basin where the basin converges between the Wind River and Teton ranges. The structural basin filled with thousands of feet of continental and marine deposits in Paleozoic and Mesozoic eras, and with river and lake deposits during the Tertiary sub-era. The anticlinal fold formed as the basin was uplifted in the mid to late Tertiary. Principal near-surface formations in the basin are the lower Tertiary Green River, Wasatch, and Fort Union formations. Wasatch strata crop out or subcrop under Pleistocene terrace alluvium over most of the PAPA.

Pleistocene alluvium consists of glacial outwash and till terraces north of the New Fork River. Recent alluvial deposits along the river flood plains are referred to here as valley fill to distinguish them from older terrace deposits. Terrace alluvium covering the Mesa in the north of the PAPA was deposited in a fan at the head of the basin, and is an erosional remnant of more continuous deposits of the Greater Green River Basin through which the Green River subsequently cut down (Bradley, 1964; Love and Christiansen, 1985; Roehler, 1992 and 1993; and Love, et al., 1993). Eight terrace levels have been identified in this flood plain complex (BLM, 1999a), constructed mainly of well-sorted, rounded cobble gravels. The modern valley fill in intermittent drainages is fine sand and weathered shale, and in major valleys is fluvial and reworked terrace gravels.

In the south of the PAPA, the Green River Formation is represented by outliers of marginal deposits of the Eocene Lake Gosiute, which, to the distant south, has accumulations of thick marlstones, oil shale, and trona.

The Wasatch Formation consists of gray and brown fluvial shales and arkosic sandstone. Elsewhere, Wasatch sandstones form gas reservoirs for hydrocarbons originating deeper in the section; in the PAPA, the sandstones are the principal water supply aquifer. These sandstones were deposited in meandering river channels and oxbows, with some overbank splays, resulting in lenses that are typically smaller than drill hole spacing, and do not correlate between individual holes. The underlying Fort Union Formation consists mainly of shales and sandstones, with coal beds.

Deeper strata, particularly the Cretaceous Lance Formation, have yielded oil and gas throughout the Green River Basin. Natural gas is found in several reservoir formations in the geologic section, with large reserves in structural traps such as the Pinedale Anticline. The Jonah Field to the southwest of the PAPA, on an extension of the anticline, is a major gas producer. These gas reservoirs are “tight sands,” which were not commercially producible until recent advances in drilling technology and enhancements, such as hydrofracturing, which opens up communication between the wellbore and the targeted sandstone.

3.13.1.2 Minerals

A schematic geological cross section of the natural gas resources in the Green River Basin is shown in Figure 3.13-1 (Ultra Resources, Inc., 2005). The Cretaceous Lance Formation is the primary target, particularly along the crest of the faulted anticline, but deeper sandstone strata, such as the Rock Springs Formation of the Mesaverde Group, are also potential targets. The PAPA is mostly to the right (northeast) of the anticline-flanking thrust fault, and the Jonah Field Project Area is to the left (southwest). In this figure, the Wasatch and Fort Union formations compose the undifferentiated Tertiary strata.

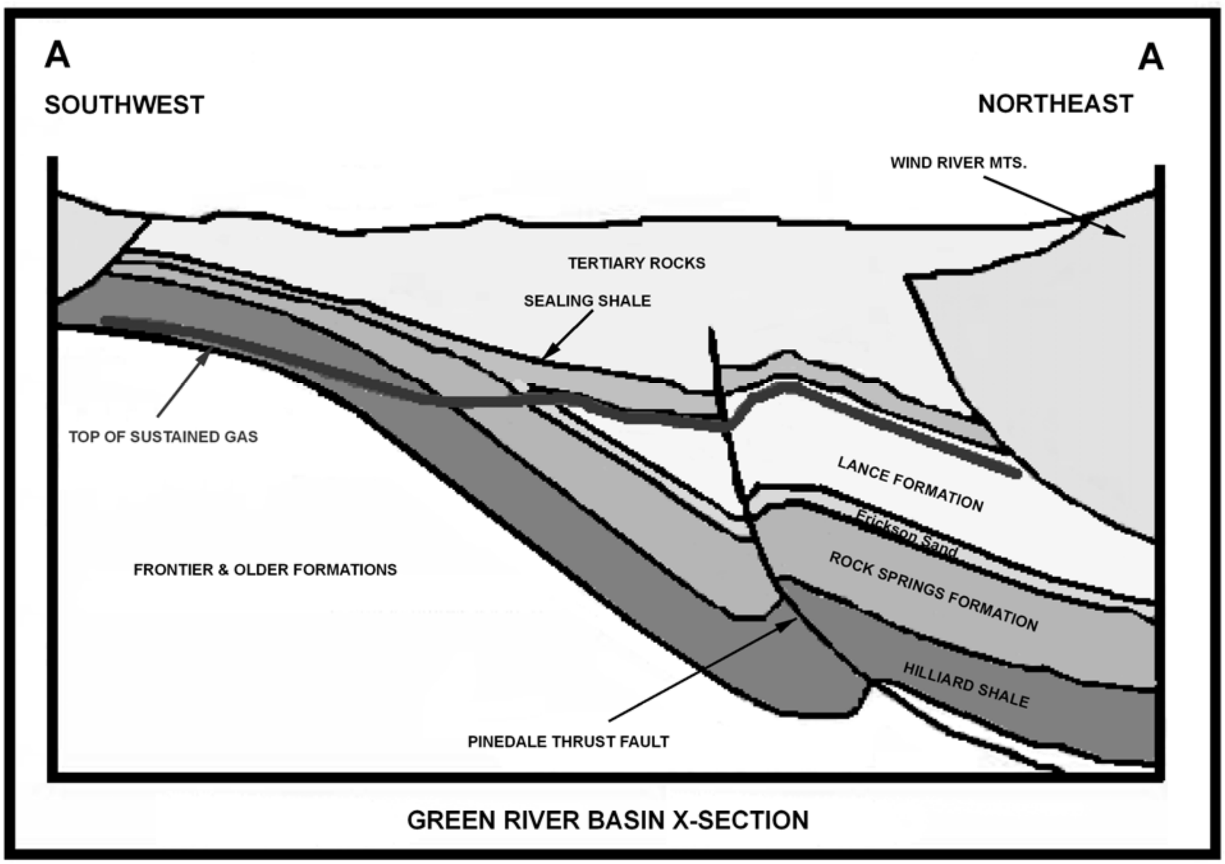


Figure 3.13-1
Geological Cross Section of the Green River Basin and Pinedale Anticline Area

USGS (Crockett et al., 2003), following Montgomery and Robinson (1997) assessed the gas potential (non-coal bed methane) in the PAPA and Jonah Field Project Area for the BLM's RMG and made the following determinations with respect to the PAPA:

- "Very High Potential Area – defined as a 1.5-mile wide band lying on the Pinedale Anticline axis including all acres 1 mile east and 0.5 mile west of the anticlinal axis with a northwest and southeast limit. This area would include over 500 additional wells per township (approximately 36 square miles)."

- "High Potential Area – defined as a 3-mile wide band lying on the Pinedale Anticline axis including all acres 2 miles east and 1 mile west of the anticlinal axis with a northwest and southeast limit. This area would include 100 to 500 additional wells per township."
- "Moderate Potential Area – defined as a 5-mile wide band lying on the Pinedale Anticline axis including all acres 3 miles east and 2 miles west of the anticlinal axis with a northwest and southeast limit. This area would include 20 to 100 additional wells."
- "Low Potential Area – includes all other areas in the PAPA and beyond. This area would include fewer than 20 additional wells per township."

3.13.1.3 Geologic Hazards

Geologic hazards are not of notable concern in the PAPA. Steep slopes in the flanks of the Mesa would be susceptible to small slides if seismically disturbed, particularly in loose alluvium-colluvium, but no slides or earthflows have been mapped in the area. Earthquake epicenters have been mapped in the immediate vicinity of the PAPA and are presumed due to movement on thrusts deep beneath the anticline. The highest recorded magnitude is III (Modified Mercalli Intensity Scale) in 1931 (Case et al., 1995). The USGS estimated that a 4.2 to 4.5 magnitude earthquake might occur somewhere in the Green River Basin every 62 years (BLM, 1999b). A widely reported magnitude 5.1 to 5.3 seismic event that occurred near Rock Springs in 1995 was found to be due to a large roof collapse in a trona mine (Pechman, 1995).

3.13.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments cross mostly flat to gently rolling plains of the Green River Basin. Deposits of three geological formations, from oldest to youngest, the Wasatch Formation (Alkali Creek Member), the Green River Formation (Laney Member), and the Bridger Formation (Bridger A), are crossed by the proposed corridor/pipeline alignments. Overlying these formations along substantial portions of the corridors is a varying thickness of Quaternary (Recent) age alluvial, colluvial, stream terrace gravels, and wind-blown sands. The slopes along the route are rated between 7 and 10 by the Natural Resource Conservation Service (NRCS), indicating slopes that are generally less than 5 percent, with limited areas displaying slopes of 5 to 10 percent (Hamerlinck and Arneson, 2002).

The proposed BCC and R6 (Segment 1) and PBC pipeline alignments cross deposits of the Wasatch Formation (Alkali Creek Member) exposed on uplands north and south of the New Fork River. The rocks of the Wasatch Formation consist of locally conglomeratic, brown, green, and gray sandstone interbedded with siltstone, mudstone, and shale.

Just south of the dissected Blue Rim Area, which is south of the New Fork River, the topography changes from gently rolling to nearly level plateau surfaces underlain by fine-grained oil shale and mudstone of the Laney member of the Green River Formation. From here, the Laney member dominates the surface geology to just south of the Green River and underlies the initial portion of the BFGC and R6 Pipeline (Segment 2) alignments. Bluffs of the Green River Formation surround Fontenelle Reservoir.

The Eocene Bridger Formation dominates most of the surface area south of the Green River that is traversed by the proposed BFGC and R6 Pipeline (Segment 2) alignments and the OPC and Opal Loop III Pipeline alignments (BLM, 1999b). The Bridger Formation consists of olive-drab and white sandstones, claystones, and conglomerates (Langeson and Spearing, 1988) that erode into rugged badlands with small sand dune and terrace gravel inclusions up to 3 feet deep. The windblown sand deposits have been stabilized by vegetation.

Rocks of the Wasatch, Green River, and Bridger formations are overlain with younger unconsolidated sediments of Quaternary age along segments of the proposed corridor/pipeline alignments that cross river bottoms, stream terraces, and buttes. The Quaternary sediments include alluvium, colluvium, stream terrace gravels, and wind-blown sands.

Lands crossed by the proposed corridor/pipeline alignments do not show evidence of major landslides (BLM, 1999b). There are no known active faults along the proposed corridor/pipeline alignments (Wyoming State Geological Survey et al., 2000).

3.14 PALEONTOLOGICAL RESOURCES

3.14.1 Development in the PAPA

Paleontological resources include the remains or traces of any prehistoric organism that has been preserved by natural processes in the earth's crust. The BLM manages paleontological resources for their scientific, educational, and recreational values in compliance with the Antiquities Act of 1906, in order to protect and preserve representative resource samples in the PAPA. The Probable Fossil Yield Classification (PFYC) system, as adapted by the BLM's Regional Paleontologist, serves as a guide for classification of potential paleontological resources (BLM, 2003c). The PFYC is a classification system wherein geological units are classified according to the probability of yielding paleontological resources that are of concern to land managers (USFS, 2001). Decisions to restrict areas for resource protection are evaluated on a case-by-case basis for each proposed surface disturbing activity.

Twenty-five recorded localities occur within the PAPA (Winterfeld, 1998). A review of the institutional records by Winterfeld (1998) identifies 59 fossil localities of importance near the PAPA. A published report on the geology and paleontology of the area (West, 1973) identifies an additional 15 localities of importance.

The Green River and Wasatch formations have high potential for yielding significant paleontological resources within the PAPA. Fossils can be found where formation outcrops exist and in areas where surface disturbance exposes the formations. In general, the more accessible the area, the greater the potential for resource discovery. Fossils, as a part of the substratum, are constantly being exposed by erosion (Robinson, 1998).

The Blue Rim Area of the PAPA is especially vulnerable to exposure of paleontological resources because it contains highly erodible Wasatch soils that have little vegetative ground cover. This area was included in MA 7 (Ross Butte/Blue Rim) in the PAPA DEIS (BLM, 1999a). Objectives of this MA are to protect the paleontological resources and to avoid disturbing the outcrops of the Wasatch. As of November 2006, there were approximately 565 acres of wellfield disturbance on federal and non-federal lands in the Blue Rim Area (Table 3.17-1). Several vertebrate fossils, including turtles, crocodilians, and fish, were recorded at paleontological localities in the Blue Rim Area (Drucker, 2006). Most recently, a fossil mammal, possibly that of an early rodent, was found during construction of a road leading to a cellular communications tower site on Ross Butte (Drucker, 2006).

Limited outcrops of the Green River Formation exist in the southeastern portion of the PAPA, near the Jonah Field Project Area. The formation is well known for its abundant fossil specimens. The lack of documented fossils in the PAPA is most likely because the areas have not been sufficiently studied (BLM, 1999a).

3.14.2 Pipeline Corridors and Gas Sales Pipelines

The exposed bedrock formations underlying the proposed corridor/pipeline alignments include the Wasatch Formation (Alkali Creek Member), Green River Formation (Laney Member), and

Bridger Formation (Bridger A and B). These formations, which are exposed intermittently along the proposed corridor/pipeline alignments, produce scientifically significant fossils, have the highest paleontological potential and meet the BLM's standards for Paleontology Condition 1 and PFYC 4 and 5 (Hanson, 2006).

Varying thicknesses of Quaternary (Recent) age sediments overlay these formations along portions of corridors crossing river bottoms and some uplands. For the most part, these sediments are too young to contain fossils; however, one locality in Quaternary sediments along Yellow Point Ridge has produced prehistoric horse remains of unknown age (Vlcek, 2005).

The Alkali Creek Member of the Wasatch Formation formed in fluvial and flood plain environments in a northwest trending band about 25 miles wide that extended from just east of the Wyoming Thrust Belt to near Pinedale. This deposit underlies the proposed BCC and the R6 Segment 1 and PBC pipelines to south of the Blue Rim Area. Fossil vertebrates are fairly common in the variegated mudstones. Fossil localities have also been recorded in the member in T. 28-32 N., R.108-112 W. (West, 1969 and 1973).

From just south of the Blue Rim Area, the proposed corridor/pipeline alignments cross exposures of the Laney Member of the Green River Formation to points just south of the Green River. Scientifically significant fossils have been known to occur in the Laney Shale Member of the Green River Formation for more than 150 years (Grande, 1984 and 1989 and Breithaupt, 1990). The first discovery of fossil fish was made by Dr. John Evans near Green River, Wyoming. The first of these specimens was sent to Joseph Leidy in Philadelphia and identified as a herring, *Clupea humilus* in 1856. The herring was renamed *Knightia eoceaena* and has subsequently become Wyoming's State fossil.

Since this early discovery, many collections of fossil fishes, other vertebrates, insects and plants have been made from the Green River Formation and the specimens are world renowned for their preservation. Collections of specimens are housed in many major museums around the world and sold in rock shops across the United States. In addition to fish, a wide variety of other fossils, including the remains of amphibians, reptiles, birds, invertebrates, and plants are known from the Laney Shale (Bradley, 1964; West, 1969 and 1973; and Grande, 1984). Plant and insect fossils are very common. The most common insect fossil is the mosquito, *Culex* sp. Other invertebrate fossils known from the Laney Shale include insects, ostracodes, mollusks, and gastropods. Numerous plant fossils occur as well, with the remains of *Plantanus* sp. (a sycamore) and *Equisetum* (scouring rush), being especially common (MacGinitie, 1969). In places, remains of algal mounds, or stromatolites, occur and may exceed a few feet in height and 15 feet across.

Among vertebrates, the most common fish in the Laney Shale include the herring genera, *Knightia*, and *Gosiutichthys*. Other vertebrates, including birds, salamanders, turtles, crocodilians, and mammals, are rarely reported. At least one complete articulated turtle and a two nearly complete crocodilian skeletons are known from the member, as well as some undescribed mammalian skeletons in private collections. The remains of small perching birds, primobucconids, are also known from the Laney Shale, but the most abundant bird remains are the impressions of feathers (Olsen, 1987 and 1992).

From points just south of the Green River, the proposed corridor/pipeline alignments cross exposures of the Bridger Formation. Fossil vertebrates have been collected from the Bridger Formation for more than 135 years (Leidy, 1856) and collections of Bridger specimens are housed at nearly every major paleontological institution in the world. The abundance of fossil vertebrates in the Bridger Formation along the proposed corridor/pipeline alignments has been documented in previous project reports (EVG, 1999, 2001a, 2001b, 2002a, and 2002b). Fossil turtles and other reptiles are the most common vertebrate fossil in the Bridger Formation.

Although most specimens are fragmentary, complete skeletons of mammals and reptiles (crocodiles) have been collected (McGrew, 1971 and McGrew and Feduccia, 1973).

Preconstruction field and open trench field monitoring in the multi-pipeline corridor between the Bird Canyon Compressor Station and the Granger Gas Processing Plant have been conducted frequently since 1998 (EVG, 1999, 2001a, 2001b, 2002a, and 2002b). Monitoring confirms the presence of vertebrate fossils in the surface lithology along existing pipeline rights-of-way.

3.15 GROUNDWATER RESOURCES

3.15.1 Development in the PAPA

Groundwater resources are important in the PAPA, with wells supplying domestic and stock water to rural residences in areas far from perennial streams. Groundwater also partially supplies drilling water to the Operators. The area is arid, and the watercourses flowing from the PAPA are generally intermittent.

3.15.1.1 Aquifers

Most domestic and stock wells are less than 200 feet deep, and draw water from alluvium. The most prolific alluvial deposits are an older remnant of outwash gravel on the Mesa, and modern river alluvium. There are several distinct alluvial systems. The oldest is the terrace outwash gravels, which were deposited as an outwash apron stretching from the Wind River Range, and cut by the New Fork River. This outwash apron is up to 150 feet thick on the Mesa. Modern river gravels occupying the flood plains of the New Fork and Green rivers are the next youngest aquifer system, and their alluvial water is directly connected to the stream flow. Valley fill alluvium in watercourses draining the PAPA is an accumulation of colluvium, probably silty with low yield. In the south of the PAPA, there is some wind drift sand cover constituting a minor alluvial aquifer.

The relationship between these formations and aquifers is shown schematically in Figure 3.15-1. Stock and domestic wells tap shallow groundwater, generally from alluvium. Drilling water supply is obtained by Operators from the Wasatch Formation. This water may also be used for stock water upon favorable results of water quality testing. Gas is currently produced from the Lance Formation. Natural gas wells and drilling water supply wells are required to be cased and cemented to isolate all water bearing zones above their particular production intervals. Fort Union groundwater is not generally used in the Green River Basin and is not well characterized (Glover et al., 1998).

3.15.1.2 Recharge

Regional potentiometric maps (Glover et al., 1998) for the Wasatch Formation indicate groundwater flow from recharge areas in the north of the Green River Basin southward, to discharge to the Green River in the area of Fontenelle Reservoir. Alluvial aquifers in the PAPA are recharged by local precipitation. The aquifers discharge to surface water directly or through valley fill alluvium in local drainages.

Annual precipitation is approximately 20 inches in the Wyoming Range (Lowham et al., 1985), and up to 30 inches in the Wind River Range, where the Wasatch Formation is apparently recharged. Because the Wasatch Formation does not crop out against the Wind River Range (as shown in the cross section of Figure 3.15-1), infiltration is likely to be less than 1 inch per year in this primary recharge area. Hamerlinck and Arneson (1998) indicate average infiltration rates within the basin (groundwater recharge from precipitation) of 0.25 to 0.6 inches per year in the Pinedale area. This range of values gives an estimate of annual recharge over the PAPA of between 4,000 and 10,000 acre-feet/year.

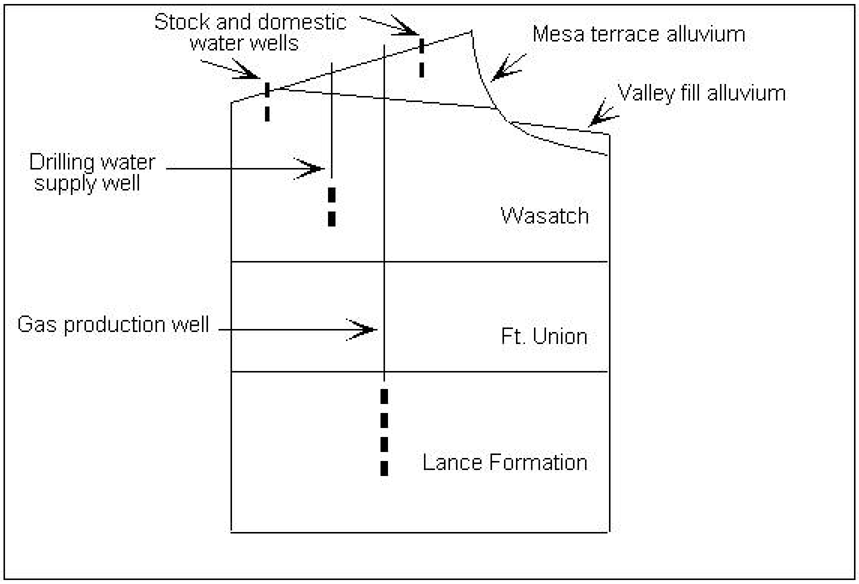


Figure 3.15-1
Relationship Between Major Formations and Aquifers

Probably less than half the local recharge in the PAPA is to groundwater that is used for stock and domestic supply. Most of the remaining recharge discharges from alluvium to surface water. A small fraction of the recharge passes through the alluvium into the Wasatch Formation aquifer. Potentiometric data indicate that the Wasatch Formation aquifer discharges some groundwater to the New Fork River in the reach crossing the PAPA. The smaller streams south of the New Fork River do not show this apparent connection between surface water and groundwater.

3.15.1.3 Groundwater Quality

The terrace alluvium aquifer has Class I quality water (WDEQ, 2005a), which means that total dissolved solids (TDS) are less than 500 milligrams per liter (mg/L), and no constituent concentration exceeds drinking water standards. Predominant ions are calcium and bicarbonate.

The Wasatch Formation contains many discontinuous sand lenses with variable connectivity and variable water quality. Sand lenses typically cannot be correlated between drill holes because they are smaller than drill hole spacing. Therefore, the Wasatch Formation aquifer can only be discussed in a statistical manner. This complicates discussion of its hydraulic properties (yield, flow patterns) and water quality. The lumped Wasatch Formation groundwater quality ranges from a sodium bicarbonate type (sodium and bicarbonate are the dominant ions), with TDS less than 500 mg/L, to sodium sulfate-bicarbonate type with TDS up to 1,500 mg/L. Thus, the classification ranges from Class I (TDS less than 500 mg/L, suitable for domestic use) to Class III (suitable for stock use) (WDEQ, 2005a). Sulfate increases with TDS, but there is no evident geographic trend in TDS or any ionic constituent.

Sulfate and TDS data from Wasatch Formation monitoring wells are plotted in Figure 3.15-2, showing concentrations with low-salinity sodium-bicarbonate, and low to moderate salinity sodium-sulfate. The pH of Wasatch Formation groundwater has two modes (frequency peaks, at 8.2 and 9.7), as shown in Figure 3.15-3. The pH does not correlate with TDS, depth, or any other measured parameter, and has been suspected to be due to cement leakage in some of the sampled water supply wells. However, other studies have measured regional pH in the Wasatch Formation aquifer commonly between 8.5 and 9.5 (Chafin and Kimball, 1992). Wasatch Formation water quality ranges from Class I (drinking water) to Class III (stock water) (WDEQ, 2005a). Any Wasatch Formation water is suitable for drilling, but water with higher salinity may not be appropriate for cementing.

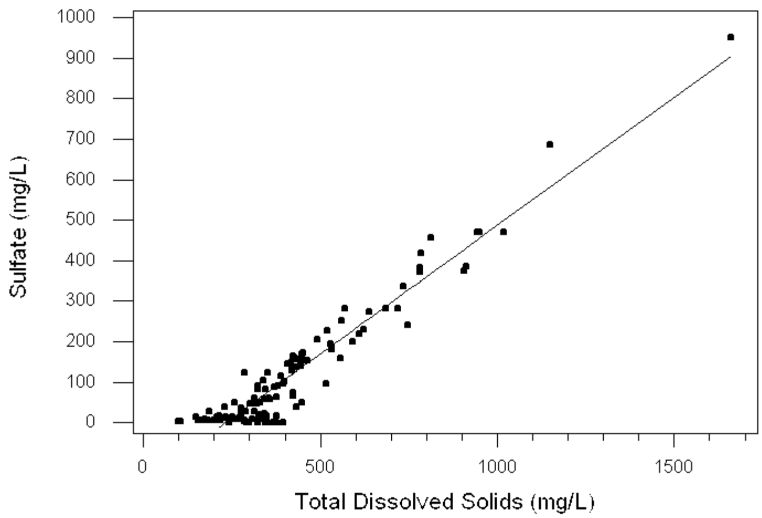


Figure 3.15-2
Relationship of Sulfate Concentrations to Total Dissolved Solids in Wasatch Groundwater

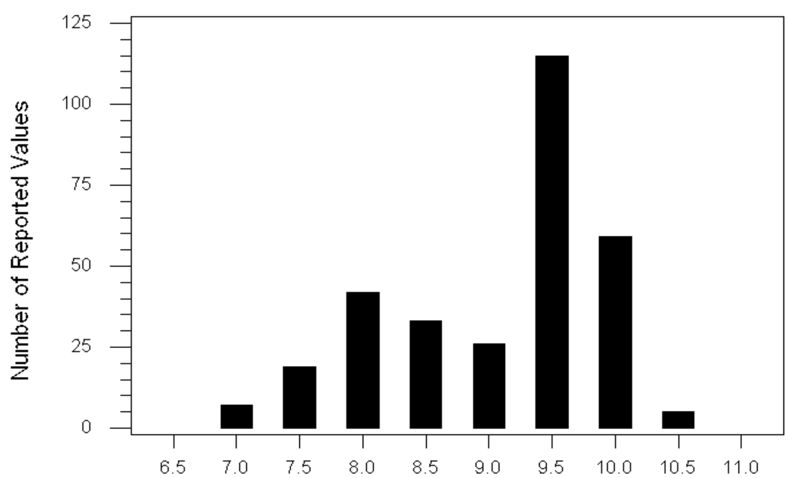


Figure 3.15-3
Distribution of pH in Wasatch Groundwater

Fort Union Formation sandstones generally contain water with salinity greater than 2,000 mg/L (Glover et al., 1998), which may be adequate in some places for stock and drilling uses. Most Class 2 wastewater injection wells in the vicinity inject into the Fort Union Formation. Because this water has TDS values above 3,000 mg/L (criteria for aquifer exemption), an aquifer exemption has been obtained for each of the injection wells.

PAPA valley fill alluvium groundwater is a mix of surface water, Wasatch Formation water, and alluvial water. The valley's water quality is expected to reflect the calcium-sodium bicarbonate composition of the source waters. Currently, there are no monitoring wells in the valley fill alluvium to provide accurate water quality information.

Produced water from the gas-producing interval of the Lance Formation has high salinity and some dissolved organic constituents. Produced water is discussed in Appendix 7 and in Section 3.16 - Surface Water. The Lance Formation has poor water quality although it could be treated to meet discharge or use standards.

3.15.1.4 Groundwater Quantity

Historically, groundwater development in the PAPA consisted of stock and domestic wells completed in terrace or river alluvium. Some bedrock wells exist south of the New Fork River where alluvium is thin. Alluvial wells furnish Class I water, with water levels typically less than 50 feet.

Natural gas exploration and production has required water for drilling, in the quantity of approximately 20,000 bbl per gas well. Most of this drilling water has been obtained from water supply wells installed in the Wasatch Formation aquifer ranging from 200 to 1,000 feet in depth. Water for drilling is also obtained from recycled produced water. Wyoming State Engineer's Office (SEO, 2006) water rights database shows approximately 4,000 adjudicated points of use, of which 414 are for industrial use (gas production). Many of these records are duplicates of registered wells because each point of use acquires its own record. Rationalizing this database and others at USGS and WDEQ-WQD has been attempted (Dynamac, 2002), but a complete and verified list of wells in the PAPA and their construction and survey details has not been completed.

Some groundwater is used for dust control. The quantity of water used varies widely between Operators, with estimates for 2006 ranging from 10,000 to 20,000 barrels per day (bbl/day). Use of groundwater for dust control is seasonal and depends on road surfaces in a particular work area, the amount of traffic, and the extent to which the Operator uses treated produced water for dust control. Some treated produced water has been used on a trial basis, with reverse osmosis added to the treatment to remove trace metals.

The dominant flow direction in alluvial terrace deposits and Wasatch Formation water-bearing units north of the New Fork River is toward the New Fork River, which cuts across the PAPA. Again, supply wells in the Wasatch Formation average the Wasatch Formation potentiometric level (the elevation at which water stands in a well), and many individual observations do not follow the pattern, but the overall potentiometric gradient (the flow direction) in the Wasatch Formation is to the south as indicated in regional maps (Glover et al., 1998). Where the New Fork River crosses the PAPA, potentiometric contours converge on the New Fork elevations. This indicates that the groundwater is flowing to the river which means that the river is gaining by groundwater discharge in that reach. Groundwater discharge to stream baseflow north of the New Fork River occurs principally in watercourses via valley fill alluvium. Exposed springs are not common in the PAPA.

South of the New Fork River, where relief is lower, the Wasatch Formation groundwater appears to flow toward the Green River, bypassing ephemeral watercourses draining east and west. There is less infiltration to groundwater south of the New Fork River where there is lower precipitation (Lowham, et al., 1985) and finer-grained soils.

Depths and water bearing zone thicknesses for drilling supply wells in the PAPA monitored in 2005 are plotted in Figure 3.15-4. Well depths range from 300 to 1,000 feet, confirming that they are Wasatch Formation wells. The thickness of the water bearing interval is typically less than 200 feet.

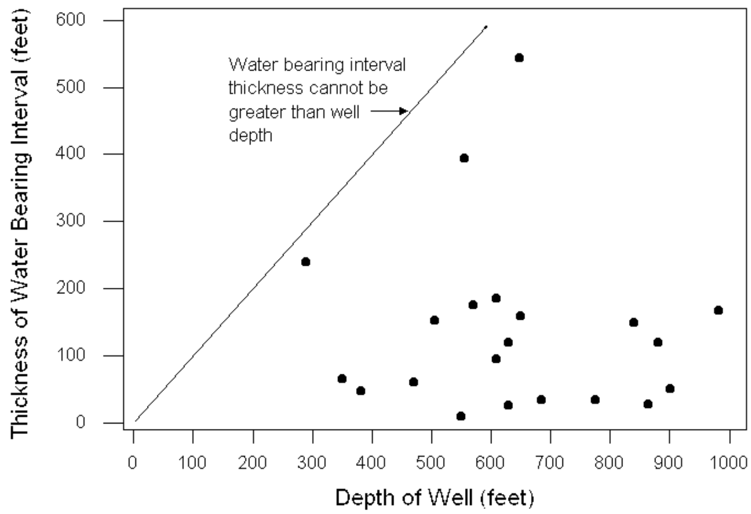


Figure 3.15-4
Data from Drilling Supply Wells in the PAPA

The nature of the local watercourse alluvium north and south of the New Fork River is not known, but it is expected to be predominantly accumulated colluvium, fine-grained, and of low yield. These deposits are of interest primarily as conduits for sub-flow of groundwater to surface water.

3.15.1.5 Groundwater Monitoring

Groundwater monitoring for baseline characterization began following issuance of the PAPA ROD (BLM, 2000b). The PAPA ROD required that "… The Operators conduct a survey and a complete water analysis (e.g. static water level, alkalinity, salinity, benzene, oil, etc.) of all water wells within a 1 mile radius of existing and proposed development, and annually monitor and maintain a complete record of water analysis of all new water supply wells drilled in the PAPA to evaluate the quality of source options in the event some mitigation is required." Some sampling was conducted prior to 2002.

Since July 2001, the Sublette County Conservation District (SCCD) has inventoried water wells within 1 mile of existing or proposed natural gas wells in the PAPA. SCCD sampled groundwater in over 230 wells from August 23, 2004 through June 30, 2007 on behalf of PAPA Operators. Many, if not most of these wells, have uncertain open intervals and they are completed across various sands of the Wasatch Formation. Because these sands are lenticular ancient river channel deposits in low permeability shales, sands cannot readily be correlated between borings and generally different units are intersected in every well (well spacing is typically greater than the width of a channel deposit). The Wasatch Formation is therefore characterized by this baseline program as a compound aquifer system with variable chemistry.

The monitoring program established by the PAPA ROD (BLM, 2000b) detected benzene and other hydrocarbons in four PAPA drilling water supply wells in late 2006. As a result, WDEQ-WQD has required Operators to analyze samples from all water supply wells for BTEX and total petroleum hydrocarbons (TPH). As of October 2007, benzene and other volatiles have been detected in an additional 84 wells. Two wells showed benzene at concentrations higher than the MCL (maximum concentration level for a constituent, defined in the Safe Drinking Water Act) and the others were lower than the MCL. Where detections are above the MCL, the contamination is known to be related to drilling pit water siphoning back into the well and to backflow from transportation trucks. WDEQ-WQD has since required that check valves be installed on supply wellheads. All water supply wells have also been outfitted with locks to prevent unauthorized access. The source of the widespread low concentration detections (lower than the MCL) is not known.

3.15.2 Pipeline Corridors and Gas Sales Pipelines

Most of the proposed corridor/pipeline alignments cross outcrop and colluvium-covered subcrop of Tertiary-age rocks, although they also cross alluvium in river valleys, and some thin eolian sands. Quaternary aquifers are thin and low-yielding except for where they are in direct contact with rivers. Tertiary aquifers are lenticular sands of the Wasatch Formation and, in the south, fractured siltstones of the Green River Formation. The potential for groundwater contamination is low to medium except along the river drainages (Hamerlinck and Arneson, 1998). Groundwater in the Green River Basin is used for agricultural, municipal and domestic, and industrial purposes (States West Resources Corporation, 2001).

There are existing water wells near the proposed corridor/pipeline alignments, primarily in the area surrounding Granger and near the Granger Gas Processing Plant (BLM, 2004c). Well yields from the Wasatch Formation aquifer are between 20 and 500 gallons per minute (gpm).

Groundwater quality varies by location and by aquifer (Hahn and Jessen, 2001) in the proposed corridor/pipeline alignments. The concentration of TDS exceeds the secondary drinking water standard in more than half of the wells sampled, and sulfate exceeds the secondary drinking water standards in about one third. Although the water quality of these higher TDS and sulfate waters does not necessarily prevent their use, it limits their suitability. The quality of groundwater at several locations is considered poor, and would require extensive treatment to produce suitable drinking water. Hahn and Jessen (2001) reported that there was insufficient data available to assess whether alternative groundwater sources of better quality might be accessible in areas crossed by the proposed corridor/pipeline alignments.

3.16 SURFACE WATER

3.16.1 Development in the PAPA

The major streams in the PAPA are the Green and New Fork rivers. The New Fork River originates in the Wind River Range north and east of the PAPA, and cuts across the PAPA to join the Green River, which originates in the Wyoming and Wind River ranges to the north and northwest. These rivers are fed mostly by snowmelt, with runoff rising from April to peak flow in June. Groundwater feeds baseflow in streams from October through March, during which time there is little precipitation except for headwater snowpack accumulation. There are several reservoirs on New Fork tributaries that provide flood control, supply water to irrigation, and are recreational and fish and wildlife resources. Ephemeral streams south of the New Fork River drain the PAPA to the Green River in an area of low relief and salty soils.

The Green and New Fork rivers have high quality water above the PAPA, with TDS typically less than 100 mg/L in headwaters. Salinity in the New Fork River actually decreases along the northeast flank of the PAPA due to dilution by very low TDS streams entering from the east. In the Green River and in the New Fork River from Boulder to the Green River, salinity increases downstream are due to contributions from irrigation return flow, groundwater discharge, and runoff from salty soils in the lower reaches. These two rivers are prime sport fishing waters over their entire lengths.

Three other perennial streams passing through the PAPA are Duck Creek, East Fork River, and Pine Creek. These are all tributaries to the New Fork River. Most of the PAPA is drained by numerous ephemeral streams, each of which collect and drain water from small sub-watersheds within the PAPA. These streams also receive some seepage from groundwater, although it is insufficient to sustain surface flow throughout the year. For most, if not all ephemeral streams in the PAPA, runoff peaks during snowmelt. Thunderstorms can also generate sporadic stream flow.

There are 21 sub-watersheds (Hydrologic Unit Code level 6 in USGS classification) draining the PAPA (see Map 3.16-1); ten of these are only on the margins of the PAPA. The largest sub-watershed complex, flowing to the New Fork River in the eastern portion of the PAPA, includes drainage from Duck Creek, Sand Springs Draw, and several unnamed draws and ditches. On the west side of the PAPA, Tyler Draw and a few other unnamed draws in the northwest portion of the PAPA are intermittent. North Alkali Draw and Sand Draw drain to Alkali Creek, which is tributary to the Green River from the southwest portion of the PAPA. The Green River is not present in the southwest portion of the PAPA. Water Hole Draw, Mud Hole Draw, Bull Draw, and other small drainages discharge to the Big Sandy River in the southeast portion of the PAPA.

3.16.1.1 Colorado River Basin Salinity Considerations

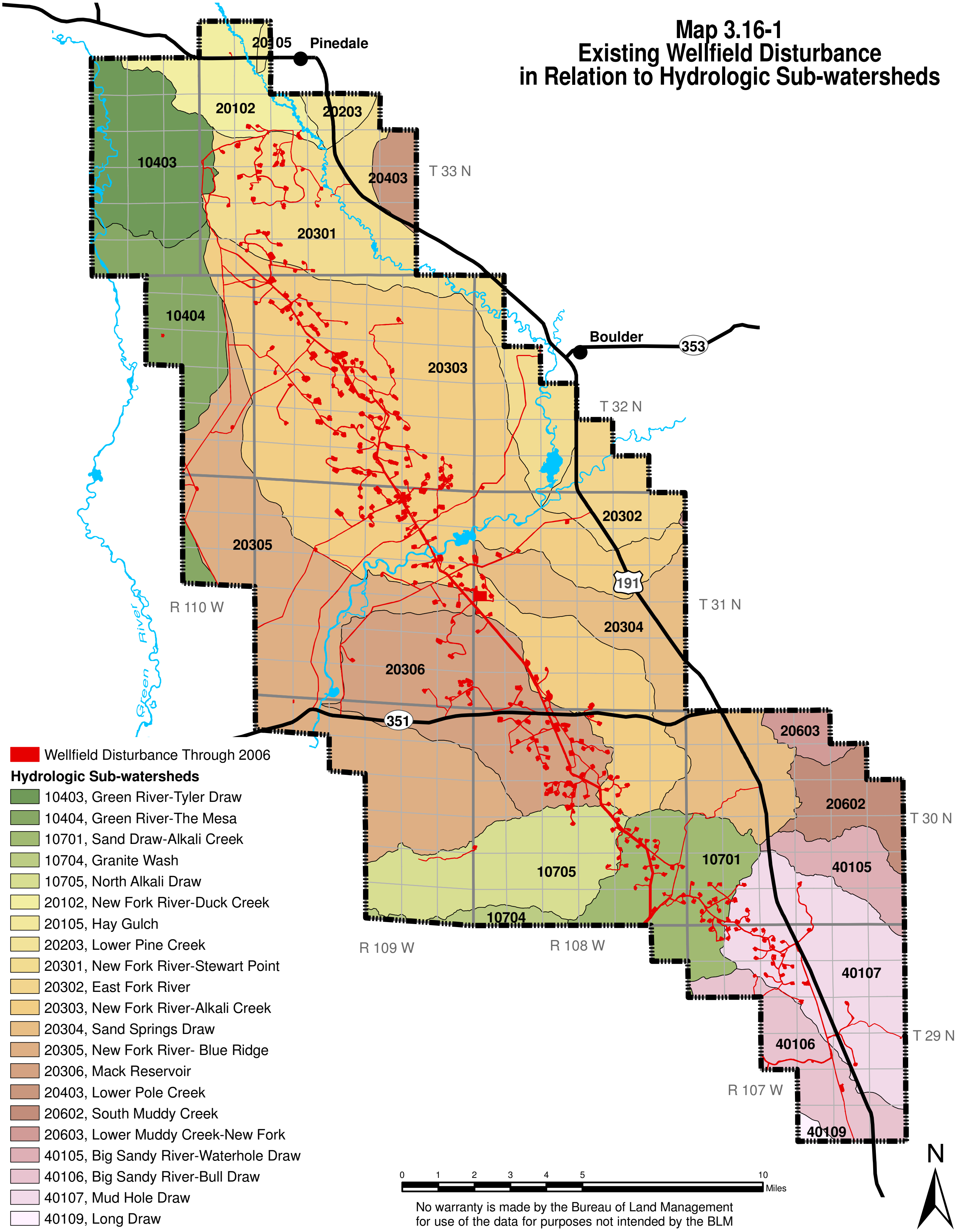
The PAPA is in the upper Colorado River Basin, for which special regulation has been enacted to control and mitigate river water salinity, in order to fulfill treaty obligations with Mexico. Congress enacted the Colorado River Basin Salinity Control Act, Public Law 93-320 1974 Title II – Water Quality Program for Salinity Control, and the 1984 Amendment, Public Law 98-569, directing the BLM to implement a comprehensive program to minimize salt loading in the Colorado River Basin. The BLM coordinates salinity control activities with the Colorado River Basin Salinity Control Forum (CRBSCF), the USBR, and the NRCS. The BLM, USBR, and NRCS receive Congressional funding for salinity control. Other federal agencies that have a stake and participate in the CRBSCF Work Group meetings include EPA, USFWS, and the USGS.

The CRBSCF identified rapidly expanding energy development in the Upper Colorado River Basin as a high-priority issue. This is because it has the potential of an adverse effect on achieving the adopted numeric salinity standards, which would violate the water-quality salinity-based standards and endanger downstream water users, and potentially affect the United States' agreement with Mexico.

3.16.1.2 Surface Water Quality

All of the Green River upstream of the confluence with the New Fork River is designated Class 1 water under WDEQ-WQD Surface Water Standards (WDEQ, 2001). This means that these are "outstanding" waters that may not be degraded. The waters of the New Fork River and tributaries are Class 2AB, meaning that they meet the same standards as Class 1, at least seasonally, but are protected by use determination rather than value determination under WDEQ-WQD rules. Neither the Green River or New Fork River nor any of their tributaries in the PAPA are included in Wyoming's Section 303(d) 2006 list of impaired waters (WDEQ, 2006).

The SCCD monitors water in the streams of the New Fork basin quarterly. Details of the monitoring program are found in the Sampling and Analysis Plan (SCCD and PAWG, 2005). The samples are collected in March (estimated spring runoff peak), July (peak flow), and the first week in September and November. Biological samples are taken in the latter two periods.



Map 3.16-1
Existing Wellfield Disturbance
in Relation to Hydrologic Sub-watersheds
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
20105
20102
20203
20403
10403
20301
10404
20303
20302
20305
20304
20306
20603
20602
10701
10705
10704
40105
40107
40106
40109
Wellfield Disturbance Through 2006
Hydrologic Sub-watersheds
10403, Green River-Tyler Draw
10404, Green River-The Mesa
10701, Sand Draw-Alkali Creek
10704, Granite Wash
10705, North Alkali Draw
20102, New Fork River-Duck Creek
20105, Hay Gulch
20203, Lower Pine Creek
20301, New Fork River-Stewart Point
20302, East Fork River
20303, New Fork River-Alkali Creek
20304, Sand Springs Draw
20305, New Fork River- Blue Ridge
20306, Mack Reservoir
20403, Lower Pole Creek
20602, South Muddy Creek
20603, Lower Muddy Creek-New Fork
40105, Big Sandy River-Waterhole Draw
40106, Big Sandy River-Bull Draw
40107, Mud Hole Draw
40109, Long Draw
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Annual reports that include monitoring analysis data, compilation of spill reports from the PAPA, and incremental surface water sampling are prepared and provided by the SCCD to the PAWG Water Resources Task Group and the BLM by December 1 of the same year. They are reviewed with the public during the annual AM review, as required by the PAPA ROD (BLM, 2000b).

A report by EcoAnalysts, Inc. (2005) concluded that there had been no discernible change in water chemistry, salt load, sediment load, or invertebrate biology indices between 2000 and 2005. Suspended sediment load (field measurement of turbidity and lab measurement of total suspended solids) is not statistically higher just above the confluence with the Green River than it is at upstream stations. EcoAnalysts, Inc. inspected the bed for indications of increase in fine bed load which would impair aquatic life.

There are three stream monitoring points relating directly to the PAPA. They are on the New Fork River above the PAPA (NF4) and one each upstream (NF30) and downstream (NF19) of the point where the New Fork River crosses the PAPA. Data show that salinity (as TDS) decreases down the northwest flank of the PAPA (from NF4 to NF30), then increases again across the PAPA to NF19. The decrease is due to dilution by tributaries coming off the Wind River Range (such as Pole and Boulder creeks). The increase is due to Alkali Creek and other drainages entering the PAPA. TDS in the New Fork River above Pinedale (NF4) seasonally exceeds 500 mg/L. It is lowest in high water, when more water comes directly from snowmelt, and highest in low flow periods when groundwater seepage in upper catchments sustains baseflow. New Fork River water has predominantly calcium and bicarbonate ions, and is approximately pH neutral (headwater streams average pH 8).

Total suspended solids (TSS), measured at the same monitoring points, is often used as an index of increase or decrease of total sediment (no simple method exists for measuring total sediment load, which has suspended and bed load components). TSS is generally less than 10 mg/L in all waters of the New Fork catchment, but variable in the spring, when rain showers can cause it to rise. Many reports are given over 20 mg/L in spring. Highest TSS values in the monitoring record are from the New Fork River near the Green River confluence, below Alkali Creek. SCCD does not monitor water quality in the Green River, but Lowham (1985) indicated suspended solids averaged 23 mg/L in the upper Green River above the PAPA.

The presence of aquatic insects, such as mayflies, stoneflies, and caddisflies, is an indicator of stream health, because these species are considered to be highly sensitive to disturbance. Conversely, an abundance of nematodes, spiders, and mites can indicate that a stream is stressed. EcoAnalysts, Inc. surveyed invertebrate life in the New Fork catchment annually between 2000 and 2005 to assess the condition of the river. Samples taken at five SCCD monitoring points suggest that stream health in the New Fork catchment ranges from fair to very good (EcoAnalysts, 2005). More extensive sampling is required in order to confirm this evaluation. Water quality data have been sampled at each of the USGS gauge locations as shown below in Figure 3.16-1. Water quality data since 2000 are available only from the Green River, below Fontenelle Reservoir. Water temperature varies during each year ranging from around 65^{o}F in August to 36^{o}F in January (Figure 3.16-1). Water temperatures in the New Fork River follow annual patterns similar to temperatures in the Green River.

Water quality data collected at all four gauge locations noted in Table 3.16-1 include the concentration of dissolved oxygen (DO). DO solubility is limited by water temperature; more oxygen can be dissolved in cold water than in warm water, as seen in the monitoring trend in Figure 3.16-2.

Measurements of DO in the Green River below Fontenelle Reservoir show an apparent declining trend from 2000 through 2006 (Figure 3.16-3), particularly in summers (Figure 3.16-4).

This does not correlate with water temperature trends, and may be related more to biochemistry in the reservoir rather than in the Green River. It could be related to late summer growths of algae and other aquatic plants. Elevated concentrations of phosphorous, known to stimulate algal blooms, have been documented in some tributaries to the Green River (Wyoming Water Development Commission, 2001). In September 2007, the USBR announced testing of water quality in Fontenelle Reservoir to determine if toxins were present in the water due to growths of blue-green "algae" (cyanobacteria) during a late season bloom (USBR, 2007). Results of the tests are not yet available. River flows have been lower through this period, and this and other factors may contribute to reservoir DO trends.

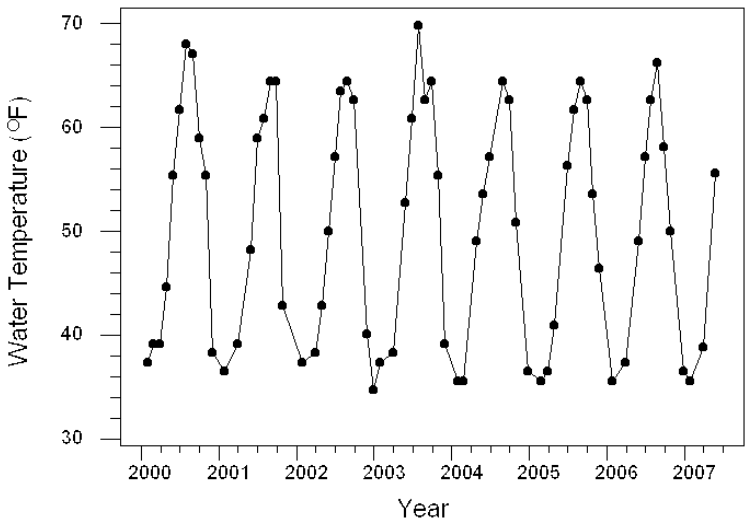


Figure 3.16-1
Variation of Water Temperatures (°F) in the Green River below Fontenelle Reservoir from 2000 to 2007

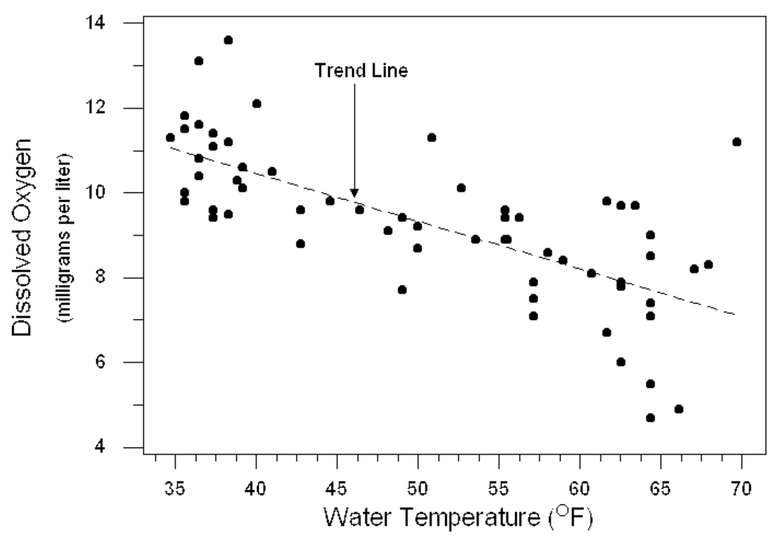


Figure 3.16-2
Relationship of Dissolved Oxygen Concentration to Water Temperature Observed in the Green River below Fontenelle Reservoir

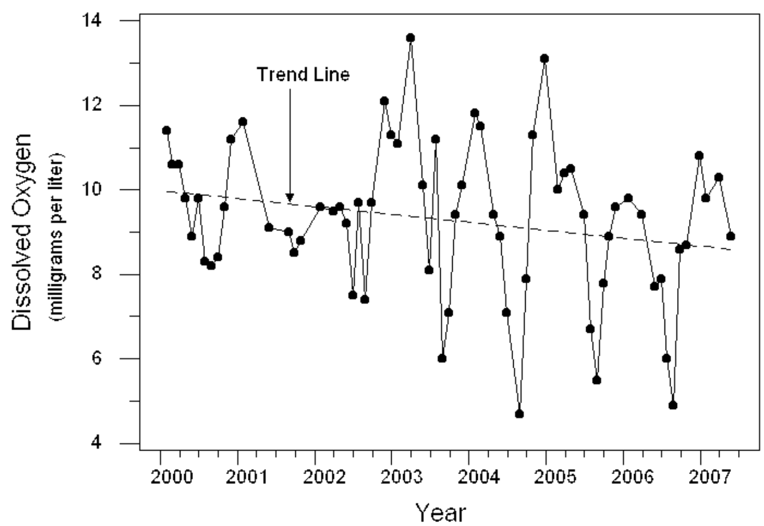


Figure 3.16-3
Declining Trends in Dissolved Oxygen Concentrations over Annual Cycles from 2000 to 2007 in the Green River below Fontenelle Reservoir.

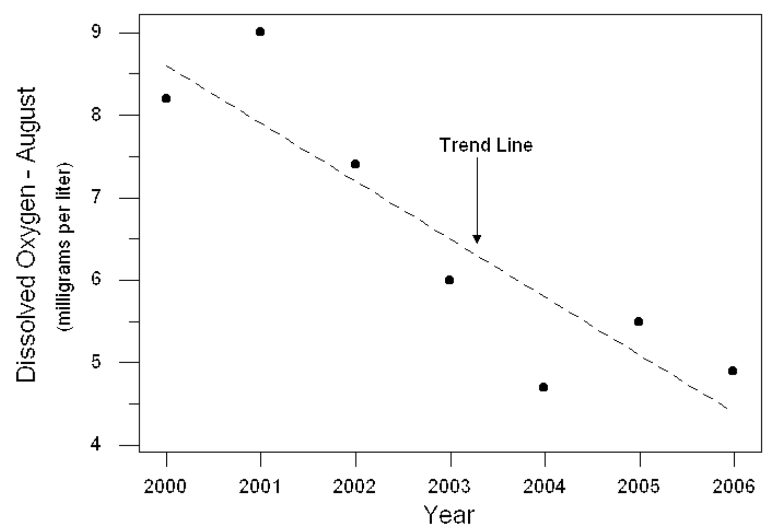


Figure 3.16-4
Declining Trends in Dissolved Oxygen Concentrations during each August from 2000 to 2007 in the Green River below Fontenelle Reservoir

3.16.1.3 Surface Water Quantity

The USGS maintains river gauging stations on the Green River near Daniel, which is upstream from the PAPA and downstream of the Fontenelle Reservoir near LaBarge. USGS gauging stations on the New Fork River are near the confluence with the Green River. The annual average flow rates (in cubic feet per second, or cfs) at these stations over the period of record are summarized in Table 3.16-1. The main tributaries to the Green River between the gauge near Daniel and below Fontenelle Reservoir are the New Fork River and Cottonwood, Big Piney, LaBarge, and Fontenelle creeks.

Table 3.16-1
Average Annual Flow Rates from Gauging Stations Near the PAPA

Gauge location	USGS Gauge Number	Period of Record	Minimum Annual Average Flow (cfs)	Mean Annual Average Flow (cfs)	Maximum Annual Average Flow (cfs)
Green River, Warren Bridge, near Daniel	09188500	1932 - 2006	280	499	768
New Fork River near confluence with Green River	09205000	1954 – 2006	313	721	1,288
Green River, near LaBarge	09209400	1963 – 2006	668	1,580	2,908
Green River, below Fontenelle Reservoir	09211200	1964 - 2005	609	1,595	3,060

With the exception of annual flows in 2005, annual average flows on the New Fork River near its confluence with the Green River have been below the long-term average of 721 cfs since 2000, most likely due to below average precipitation (see Table 3.3-1). Average flows measured on the New Fork River are directly related to total precipitation estimated on the PAPA for each Water Year (October through September) from 2000-2001 though 2006-2007 (Figure 3.16-5).

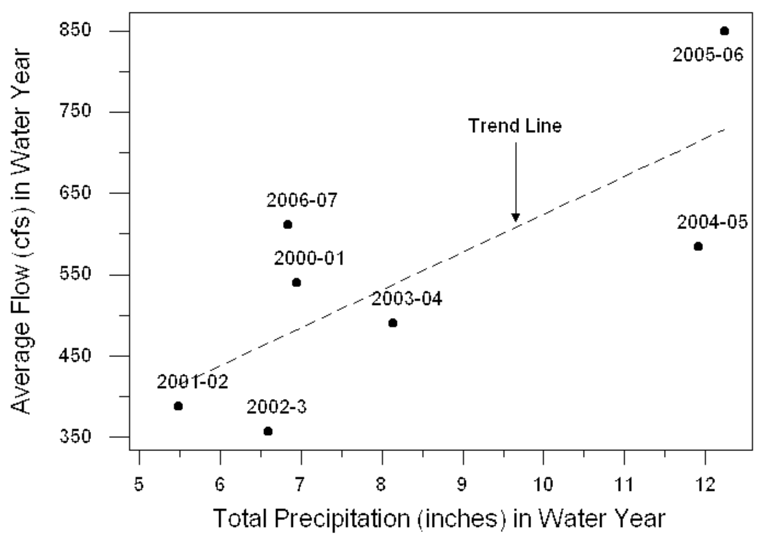


Figure 3.16-5
Relationship of Average Flows to Total Precipitation on the New Fork River During each Water Year from 2000-2001 through 2006-2007

There are approximately 377 adjudicated water rights on the New Fork River between Pinedale and Boulder, and another 270 between Boulder and the Green River (SEO, 2006). There are 54 adjudicated water rights on the Green River at the north end of the PAPA (T. 33 N., R. 110 W.). These points of diversion are predominantly for irrigation. The appropriated flows total 13,000 acre-feet/year, which is equivalent to 18 cfs.

3.16.1.4 Wellfield Development Effects

The sub-watersheds recognized by the USGS (Map 3.16-1) and the total surface area of the basins in the PAPA are listed in Table 3.16-2. The table also shows surface disturbance resulting from wellfield activities through November 2006. Most surface disturbance has occurred within the Anticline Crest.

The Mack Reservoir sub-watershed has the most disturbance in the PAPA relative to its total area within the PAPA. Over 5 percent (816 acres) of this basin in the PAPA was disturbed through November 2006. Other basins with relatively high surface disturbance as a result of wellfield activities include the New Fork River-Alkali Creek basin (4.6 percent); Sand Draw-Alkali Creek (2.1 percent), and Mud Hole Draw (1.8 percent).

3.16.1.5 Watershed Modeling

In August 2006, HydroGeo, Inc. (2006) modeled erosion and sediment loading of current conditions. Salt concentrations in stream water were not explicitly modeled, but increases in concentration are proportional to the area of soil disturbance. Two USDA models, SWAT and KINEROS2, were used to model impacts in 15 sub-watersheds. The models assumed no use of sediment control measures.

The HydroGeo report concludes that there is negligible sediment transport off low slopes in the PAPA, and up to 0.04 metric tons annually per hectare (35 lb/acre/yr) off the steepest slopes. According to the report, an average of 800 metric tons of sediment is mobilized each year in the PAPA under 2006 conditions (again, assuming no sediment control). Much of the modeled sediment mobilization occurred at low storm frequencies, but sediment largely remained within the lower basins until larger storms move it out. Some of the Operators are conducting first flush monitoring on some of the streams draining from the PAPA. For first flush monitoring, storm water samples are collected the first time a new well pad generates runoff.

Modeling indicates that current disturbances do not contribute significantly to more sediment transport than would pristine condition with no anthropogenic disturbance, except in the Mack Reservoir, Mud Hole Draw, New Fork-Alkali Creek, New Fork-Stewart Point, and North Alkali Draw sub-watersheds. Similarly, salt yield off the PAPA, through leaching of dissolved solids in soils, has probably not significantly increased due to natural gas development, except in these same sub-watersheds. The model assumed a single storm event and did not consider incremental movement over time.

3.16.1.6 Produced Water

Due to elevated TDS, sulfate, and hydrocarbons, produced water from the Lance Formation is suitable only for industrial use without treatment. Operators use produced water to drill out the gas production intervals after casing production wells through overlying aquifers. Some production water is treated and used for drilling and dust control on roads. Some production water and treatment plant waste is directed to waste injection wells.

One water treatment facility currently handles PAPA produced water, the Anticline Disposal Facility. Produced water is either piped or trucked to the Anticline Disposal Facility, depending on the Operator. The facility's capacity has expanded. In 2005, 40 to 60 percent of water used in well completions (fracturing) was produced water with minimal or no treatment. The balance of the water used for completions is either more extensively treated water or Wasatch Formation groundwater. Up to 25,000 barrels of water are used in a single well completion. About half of this water flows back immediately and is recaptured. In summer, Operators use evaporative sprinklers in the reserve pits to reduce the amount of water to be disposed.

Table 3.16-2
Existing Surface Disturbance in Relation to Hydrologic Sub-watersheds

Sub-Watershed (HUC 6)	Sub-Basin	Hydrologic Unit Code	Total Area in Basin (acres)	Total Area of Basin in the PAPA (acres)	Percent of Basin in the PAPA	Existing Wellfield Disturbance through 2006 (acres)			Percentage Disturbance in Basin	Percentage of the Basin Disturbed in the PAPA
						Federal Lands	Non-Federal Lands	All Lands		
Big Sandy River-Bull Draw	Big Sandy River	140401040106	19,768	5,761	29.1	72.3	1.0	73.3	0.4	1.3
Big Sandy River - Long Draw	Big Sandy River	140401040109	18,529	316	1.7	0.0	0.0	0.0	0.0	0.0
Big Sandy River-Waterhole Draw	Big Sandy River	140401040105	23,876	3,349	14.0	0.0	0.0	0.0	0.0	0.0
Mud Hole Draw	Big Sandy River	140401040107	19,619	12,923	65.9	346.0	2.1	348.1	1.8	2.7
East Fork River	New Fork River	140401020302	25,005	4,885	19.5	4.2	0.0	4.2	<0.1	0.1
Hay Gulch	New Fork River	140401020105	14,668	245	1.7	0.0	0.0	0.0	0.0	0.0
Lower Muddy Creek-New Fork	New Fork River	140401020603	34,520	1,492	4.3	0.0	0.0	0.0	0.0	0.0
Lower Pine Creek	New Fork River	140401020203	25,749	1,276	5.0	0.0	0.0	0.0	0.0	0.0
Lower Pole Creek	New Fork River	140401020403	20,119	1,757	8.7	0.0	0.0	0.0	0.0	0.0
Mack Reservoir	New Fork River	140401020306	15,353	15,353	100.0	640.6	175.4	816.0	5.3	5.3
New Fork River-Alkali Creek	New Fork River	140401020303	49,532	49,522	100.0	1,970.1	320.8	2,290.9	4.6	4.6
New Fork River- Blue Ridge	New Fork River	140401020305	39,853	24,909	62.5	196.0	13.1	209.1	0.5	0.8
New Fork River-Duck Creek	New Fork River	140401020102	37,229	5,521	14.8	21.2	15.1	36.3	0.1	0.7
New Fork River-Stewart Point	New Fork River	140401020301	32,670	17,218	52.7	286.4	84.4	370.8	1.1	2.2
Sand Springs Draw	New Fork River	140401020304	19,073	13,208	69.2	48.1	0.2	48.3	0.3	0.4
South Muddy Creek	New Fork River	140401020602	33,923	4,121	12.1	0.0	0.0	0.0	0.0	0.0
Granite Wash	Upper Green River	140401010704	12,218	1,091	8.9	0.0	0.0	0.0	0.0	0.0
Green River-The Mesa	Upper Green River	140401010404	41,713	7,293	17.5	4.2	0.0	4.2	<0.1	0.1
Green River-Tyler Draw	Upper Green River	140401010403	34,761	8,834	25.4	18.3	0.0	18.3	0.1	0.2
North Alkali Draw	Upper Green River	140401010705	15,918	9,959	62.6	113.5	21.0	134.5	0.8	1.4
Sand Draw-Alkali Creek	Upper Green River	140401010701	22,941	9,004	39.2	420.1	60.5	480.6	2.1	5.3
				198,037		**4,141.0**	**693.6**	**4,834.6**		

Waste injection wells in and near the PAPA are used to dispose of water surplus to drilling needs and treatment capacity. Injection wells used for PAPA disposal are summarized in Table 3.16-3.

Table 3.16-3
Class II Water Disposal Wells in Vicinity of PAPA[1]

Well Name[2,3]	Field	Location	Formation	Owner
1 WDW	Jonah	S. 19, T. 29 N. R. 107 W.	Upper Fort Union	BP America Production Co
36-1 Lovatt Draw	Pinedale	S. 36, T. 32 N., R. 109 W.	Fort Union – Lance	Petrogulf Corp
6-16 Riverside WDW	Pinedale	S. 16, T. 31 N., R. 109 W.	Fort Union	Ultra Resources
8 WDW S Mesa 11-24	Pinedale	S. 24, T. 30 N., R. 109 W.	Fort Union	Shell Rocky Mountain
11 Highway Federal	Pinedale	S. 3, T. 29 N., R. 107 W.	Fort Union	Yates Petroleum Corp

[1] Source: WOGCC, 2007.
[2] All wells are in Sublette County.
[3] All wells were permitted and in existence in 2006.

Anticline Disposal has a discharge permit (WY 0054224, May 2006) for up to 630,000 gallons per day of treated water (approximately 1 cfs), meeting standards for pH, chloride, radium, and TDS (500 mg/L is necessary to qualify as a clean water discharge under the Colorado River Salinity Forum). Anticline Disposal had plans to begin discharge of treated produced water in 2007. Discharged water must pass toxicity testing. An addendum to the permit requires toxicity testing on trout fingerlings, as well as the typical water flea and minnow tests. The discharge point is on the New Fork River, in Section 11, T. 31 N., R. 109 W.

3.16.1.7 Treated Sewage Water

Stallion Services treats sewage from several facilities in the PAPA through biotreatment and filtration. The Hydro-Action Portable Sewage Facility has a discharge permit from the WDEQ-WQD (05-070, March 2005) to discharge treated “gray water” by sprinkler, up to 4 inches per week. The discharge permit is valid for all counties in Wyoming. The limitation is intended to prevent water from infiltrating to groundwater. Discharge is purported to meet drinking water standards.

3.16.1.8 Surface Water Withdrawals

Operators may use river water to hydrostatically test new pipeline segments. Withdrawals are made under a S.W. 1 Temporary Permit to Appropriate Surface Water, issued by the Wyoming SEO. There must be provisions to protect fish at the pump intake. Hydrostatic test water is discharged to the surface following testing, assuring that water does not directly enter a flowing stream. Discharge is via a dissipating nozzle and dikes, and is supervised to prevent channeling or sheet-wash erosion. Discharge requires a Temporary Discharge Permit issued by the Wyoming SEO under the Federal Water Pollution Control Act (1972, amended in 1977 and since known as the Clean Water Act) and the Wyoming Environmental Quality Act, 1973, amended 1977.

3.16.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would cross three perennial streams: the New Fork River, the Green River, and the Blacks Fork River. The BCC, the R6 Pipeline, and the PBC Pipeline would cross the New Fork River, which is designated as Class 2AB by WDEQ-WQD (WDEQ, 2001). Class 2AB waters are protected for drinking water, game and non-game fish, fish consumption, other aquatic life, recreation, wildlife, agriculture, industry, and scenic value.

The BFGC and the R6 Pipeline (Segment 2) would cross the Green River below Fontenelle Reservoir. The OPC and the Opal Loop III Pipeline would cross the Green River farther west.

The Green River is designated as Class 2AB at these locations. The OPC and the Opal Loop III Pipeline would cross the Blacks Fork River, which is designated as Class 2AB by WDEQ-WQD.

None of the river segments crossed by the proposed corridor/pipeline alignments are included in Wyoming's Section 303(d) 2006 list of impaired waters, except for the Blacks Fork River (WDEQ, 2006). The proposed BFGC and R6 Pipeline (Segment 2) cross the Blacks Fork River in Section 28, T. 19 N., R. 111 W. The listed stream segment of the Blacks Fork River is approximately 2.5 miles downstream of the corridor/pipeline crossing at the confluence with the Hams Fork River in Section 32, T. 19 N., R. 111 W. This downstream segment of the Blacks Fork River is listed as impaired due to high levels of fecal coliform bacteria.

Other surface water resources near the proposed corridor/pipeline alignments include intermittent, ephemeral, and perennial streams, livestock ponds, any seeps and springs, and flood plains of the New Fork, Green, and Blacks Fork rivers (BLM, 1999b). Stream channel stability varies from fair to poor.

3.17 SOIL RESOURCES

3.17.1 Development in the PAPA

In the PAPA DEIS (BLM, 1999a), soils coinciding with the PAPA were classified into four broad groups, based primarily on differences in geologic origin (i.e., parent material and topographic or geomorphic position). The groups include: 1) terrace soils; 2) soils on pediment, alluvial fans and low terraces; 3) upland soils; and 4) alluvial soils on flood plains. No prime farmlands exist within the PAPA. Of particular concern in the PAPA DEIS were soils with characteristics that are considered sensitive to surface disturbance. The characteristics are included below:

- Group 1 - Terrace Soils. This soil group has few limiting or sensitive characteristics. The reclamation potential of this soil group is high because sufficient quality topsoil is typically present. The engineering properties of this soil group for road and well pad development are high because of the high content of coarse fragments in the subsoils. The coarse fragments increase the soil's strength and reduce or eliminate the need to haul in suitable base materials for construction purposes.
- Group 2 - Pediment, Alluvial Fans, and Low Terrace Soils. Most of these soils are characterized as non-sensitive with moderate to high reclamation potentials. The sensitive soils within group 2 include steep soils on escarpments which are either exposed bedrock (Wasatch Formation) or with shallow depth to bedrock. Such soils have a high runoff rate and erosion potential. The high runoff rate limits the effective moisture these soils receive and their shallow depth limits their water holding capacity. This causes these steep sensitive soils to be droughty which further reduces their reclamation potential.
- Group 3 - Flood Plain and Wetland Soils. Sensitive soil characteristics within this soil group include areas that are subject to flooding and soils with high water tables. This soil group has a high reclamation potential. Soils along the flood plains of the intermittent drainages in the southern end of the PAPA (e.g., Alkali Creek, North Alkali Draw, and Sand Springs Draw) are typically saline and can be sodic. Sodic soils are sensitive because of their potential to cause water quality impacts if disturbed. Eroded sediments from these soils could be transported to perennial waters. Additionally, the salinity and sodicity of these soils reduces their reclamation potential.
- Group 4 - Upland Soils. Upland soils have the greatest surface area in the PAPA. Sensitive soils within this group include steep, shallow soils or areas of exposed bedrock

(Wasatch Formation) along Blue Rim. These soils have a high runoff rate and erosion potential. The high runoff rate limits the effective moisture these soils receive and their shallow depth limits their water holding capacity. This causes them to be droughty, which severely limits their reclamation potential. Badland soils are included in this sensitive soil group. Badland soils are unique landform features composed of raw exposed slopes of shale and soft sandstone, siltstone, and marlstone.

Sensitive soils (including those with a slope of 15 percent or greater) in the PAPA comprise the Sensitive Soils SRMZ, which also encompasses the Blue Rim Area of the southern PAPA (Map 3-17-1). The NRCS is currently conducting a third order soil survey in the southeastern portion of

the PAPA and in adjacent lands in the Jonah Field Project Area. Available data from the NRCS survey were used by HydroGeo Inc. for watershed modeling.

As of November 2006, 57.6 acres of soils with slopes over 15 percent and 565.0 acres of the Blue Rim soils were disturbed as a result of wellfield activities (Table 3.17-1). Most surface disturbance to sensitive soils has been in the Blue Rim Area, primarily because the Anticline Crest passes through the eastern end of Blue Rim where the most intense natural gas development has occurred (Map 3-17-1). Within the combined area of the Sensitive Soils SRMZ, 595.2 acres had been disturbed through November 2006 as a result of wellfield development.

Table 3.17-1
Existing Wellfield Disturbance in Relation to Sensitive Soils and the Sensitive Soils SRMZ

Sensitive Soils Category	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Blue Rim Area Sensitive Soils	12,925	436.7	128.3	565.0
Sensitive Soils on slopes $\geq$ 15%	11,044	38.1	19.5	57.6
Sensitive Soils SRMZ[1]	21,645	458.5	136.7	595.2

[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

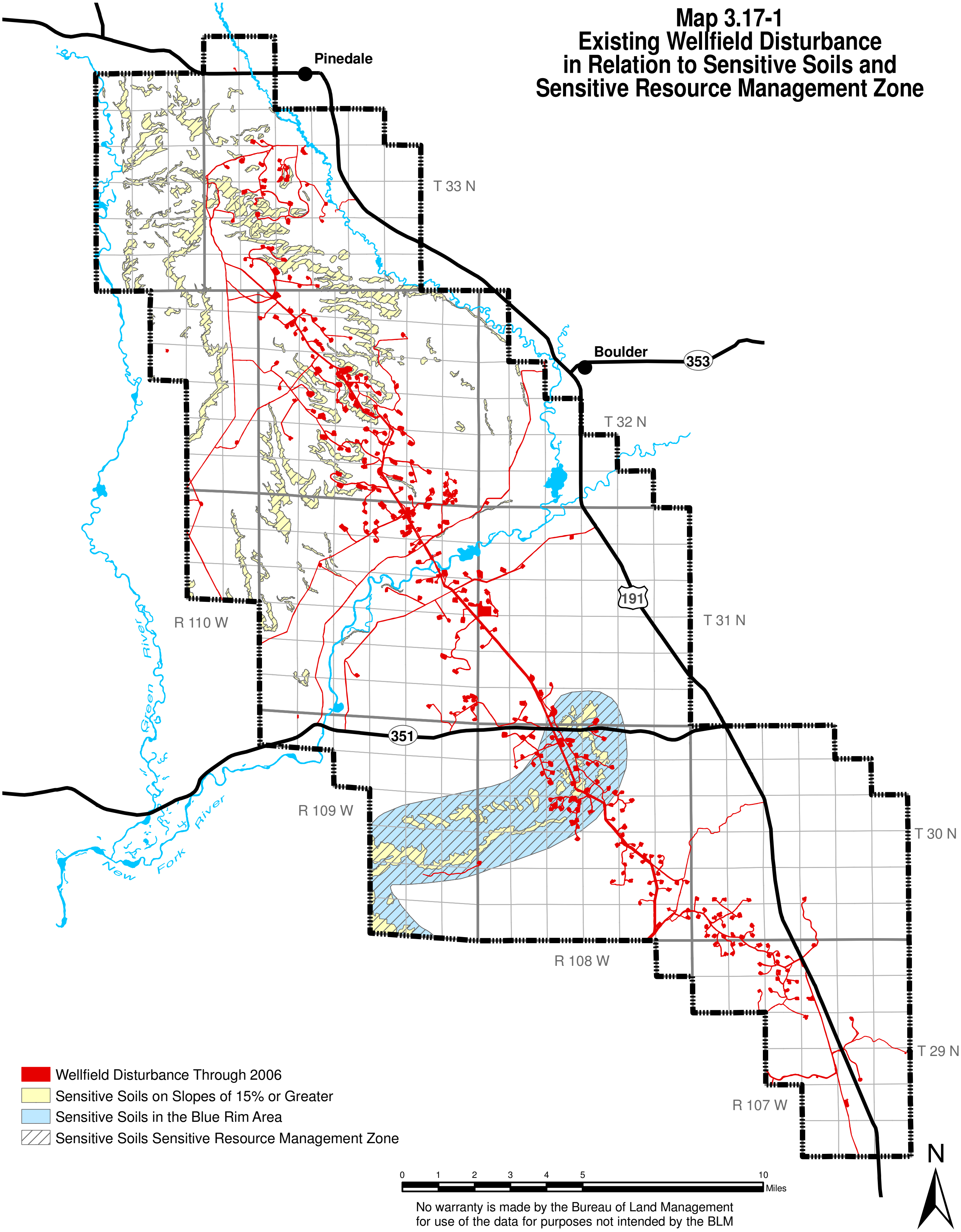
3.17.2 Pipeline Corridors and Gas Sales Pipelines

From north to south along the proposed corridor/pipeline alignments, the Wasatch Formation, the Laney member of the Green River Formation, and the Bridger Formation dominate the surface rock. These formations provide the principal parent materials for soils. Slopes range from nearly level to steeply sloping.

Soil development in upland areas with high clay-content parent materials resulted in a complex of aridic soils, or Aridisols. The majority of the upland soils crossed by the proposed corridor/pipeline alignments range from very shallow to mostly moderately deep, to deep, forming on rolling upland plains dissected by rock ravines, short escarpments, and draws (BLM, 1997 and 1999b).

The proposed corridor/pipeline alignments would cross sensitive upland soils including soils of the Blue Rim Area, which are shallow soils occupying steeper slopes and areas of rock outcrop. These soils typically have high water runoff rates and are subject to accelerated rates of soil erosion, especially when disturbed. The high runoff rates limit the effective moisture received by these soils. Their mostly shallow depth limits their water holding capacity, causing them to be droughty which limits reclamation potential.

Map 3.17-1
Existing Wellfield Disturbance in Relation to Sensitive Soils and Sensitive Resource Management Zone



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Less sensitive upland soils include shallow to moderately deep to deep soils that occupy less steep topography. These less sensitive soils are more dominant in extent along the proposed corridor/pipeline alignments, but the shallow soil depths may still limit successful reclamation should recent drought conditions continue in the Green River Basin of Wyoming.

Bottomlands associated with drainages crossed by the proposed corridor/pipeline alignments are flood plains, terraces, and tributary alluvial fans of the perennial New Fork, Green, and Blacks Fork rivers, and several intermittent drainages. The bottomland soils of these drainages form in mostly alluvial deposits, vary in texture, are deep, and are subject to flooding. These soils typically have a high reclamation potential if they are not saline or sodic. These soils can be susceptible to gully erosion when disturbed.

Soils along the flood plains of the intermittent drainages are likely to be saline and can be sodic, containing high concentrations of sodium in proportion to concentrations of calcium and magnesium in the soil (BLM, 1999b). These soils are sensitive because of their potential to cause water quality impacts, if disturbed, and potential sedimentation of downstream perennial streams. The elevated salinity and possible sodicity of these soils reduces their reclamation potential (BLM, 1999b).

3.18 VEGETATION RESOURCES

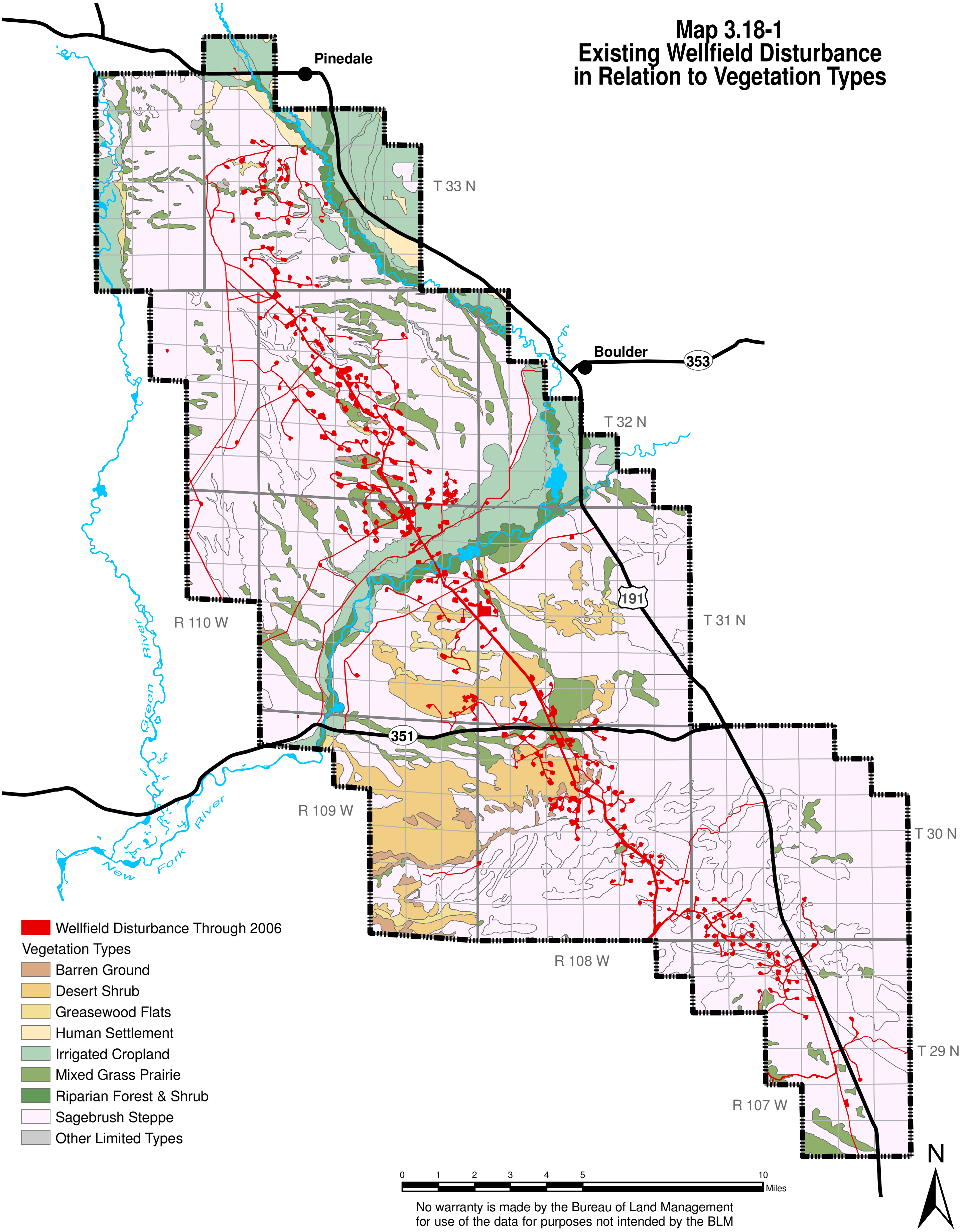
3.18.1 Development in the PAPA

In the PAPA DEIS (BLM, 1999a), BLM described nine vegetation types (excluding human settlements) in the PAPA. Some types were composites of two sub-types, for example high density and low density Wyoming big sagebrush were combined as sagebrush steppe vegetation. Shrub-dominated and forest-dominated riparian vegetation were combined as riparian forest and shrub. Vegetation in the PAPA was mapped during preparation of the PAPA DEIS and the vegetation map is available through the Wyoming Geographic Information Science Center at the University of Wyoming (Map 3.18-1).

Most wellfield disturbance has been within the two sub-types of Wyoming big sagebrush (sagebrush steppe), which cover 147,165 acres of the PAPA. As of November 2006, wellfield activities have resulted in more than 3,900 acres of disturbance to sagebrush, approximately 2.7 percent of all sagebrush-dominated vegetation in the PAPA. A large portion of mixed grass prairie (340.8 acres or 2.8 percent) has also been disturbed (Table 3.18-1).

Table 3.18-1
Existing Wellfield Disturbance in Relation to Vegetation Types

Vegetation Category	Total Area) in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Sagebrush steppe	147,166	3,441.8	490.7	3,932.5
Mixed grass prairie	11,816	323.2	17.6	340.8
Greasewood flats	1,936	39.0	0.0	39.0
Desert shrub	11,560	225.9	68.1	294.0
Riparian forest and shrub	4,349	1.1	9.6	10.7
Other limited types	323	1.7	0.0	1.7
Barren ground	1,702	4.8	11.7	16.5
Irrigated cropland	17,677	103.5	94.6	198.1
Human settlement	1,508	0.0	1.3	1.3
Total	**198,037**	**4,141.0**	**693.6**	**4,834.6**



Map 3.18-1
Existing Wellfield Disturbance
in Relation to Vegetation Types
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Vegetation Types
Barren Ground
Desert Shrub
Greasewood Flats
Human Settlement
Irrigated Cropland
Mixed Grass Prairie
Riparian Forest & Shrub
Sagebrush Steppe
Other Limited Types
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

The WGFD evaluated sagebrush growth, or production, on the Mesa since 2004 (Scribner, 2006). Production, measured as average length of sagebrush leaders was greatest in 2004 (1.25 inches) following a winter with average snowfall and above average precipitation for the water year (see Table 3.3-1 and Appendix 17, Wildlife Technical Report). Sagebrush production declined in 2005 (0.73 inches) following a winter with below average snowfall but above average precipitation for the entire water year. Because a water year extends from October through September, precipitation for water year 2005-2006 has not been analyzed. However, sagebrush production on the Mesa measured in 2006 averaged 0.12 inches; the lowest average measurement over the three year testing period (Scribner, 2006).

Annual sagebrush growth appears to be related to moisture from winter snowfall. Because total snowfall (October through April) in the PAPA has been below the 30-year average of 58 inches since 1987 (except during winter 2003-2004, Section 3.3), sagebrush production, and most likely production of other plants in the PAPA, has been limited. WGFD data indicates very few young sagebrush plants in the region with most plants classified as mature or decadent (Scribner, 2006).

Invasive, Non-native Species. Many invasive plant species are classified as noxious weeds, are aggressive, and have the ability to dominate many sites with dramatic impacts to native plant communities. Noxious weeds are defined in Executive Order 13112 as those “species whose introduction does or is likely to cause economic or environmental harm or harm to human health.” Wildlife habitat deteriorates, erosion increases, water quality diminishes, nutrient cycling and infiltration are altered, and recreational values are degraded (BLM, 1997). Weeds are often able to establish in areas following surface disturbance and are primarily present along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2003c). According to the Wyoming Cooperative Agricultural Pest Survey (CAPS), there are 24 state-designated noxious weeds and four county-declared weeds in Sublette County (Wyoming Weed and Pest Council, 2007). The declared county weeds are black henbane, scentless chamomile, field scabious, and western water hemlock. Only black henbane was considered in the PAPA DEIS (BLM, 1999a). Table 3.18-2 lists the CAPS weeds and their estimated acreages in Sublette County.

Table 3.18-2
Wyoming Designated Noxious Weeds in Sublette County

Common Name Scientific Name	Estimated Area (acres) in County for 2005	Wyoming Designated Noxious Weed [1]	Sublette County Declared Weed [2]	Weed of Concern in PAPA DEIS	Potentially Present in PAPA[3]
Black henbane *Hyoscyamus niger*	1-100	No	Yes	Yes	Yes
Canada thistle *Cirsium arvense*	5,000-20,000	Yes	–	Yes	Yes
Common burdock *Arctium minus*	0	Yes	–	No	No
Common tansy *Tanacetum vulgare*	1-100 (2003)	Yes	–	No	No
Dalmatian toadflax *Linaria dalmatica*	1-100	Yes	–	No	Yes
Dyer’s Woad *Isatis tinctoria*	1-100	Yes	–	Yes	Yes
Field bindweed *Convolvulus arvensis*	1-100	Yes	–	No	Yes
Field scabious Knautia arvensis	1-100	No	Yes	No	Yes

Common Name Scientific Name	Estimated Area (acres) in County for 2005	Wyoming Designated Noxious Weed [1]	Sublette County Declared Weed [2]	Weed of Concern in PAPA DEIS	Potentially Present in PAPA[3]
Hoary cress (whitetop) *Cardaria draba*	100-1,000	Yes	–	Yes	Yes
Houndstongue *Cynoglossum officinale*	1-100	Yes	–	No	Yes
Leafy spurge *Euphorbia esula*	1-100	Yes	–	Yes	Yes
Musk thistle *Carduus nutans*	1-100	Yes	–	Yes	Yes
Ox-ey daisy *Chrysanthemum leucanthemum*	1-100	Yes	–	No	Yes
Perennial pepperweed *Lepidium latifolium*	1,000-5,000	Yes	–	Yes	Yes
Perennial sowthistle *Sonchus arvensis*	100-1,000	Yes	–	Yes	Yes
Plumeless thistle *Carduus acanthoides*	0	Yes	–	No	No
Purple loosestrife *Lythrum salicaria*	0	Yes	–	No	No
Quackgrass *Agropyron repens*	1-100 (2003)	Yes	–	No	No
Russian knapweed *Centaurea repens*	1-100	Yes	–	Yes	Yes
Saltcedar *Tamarix spp.*	1-100	Yes	–	No	Yes
Scentless chamomile *Matricaria perforate*	1-100	No	Yes	No	No
Scotch thistle *Onopordum acanthium*	0	Yes	–	No	No
Skeletonleaf bursage *Franseria discolor*	0	Yes	–	No	No
Spotted knapweed *Centaurea maculosa*	1-100	Yes	–	Yes	Yes
St. Johnswort *Hypericum perforatum*	0	Yes	–	No	No
Western water hemlock *Cicuta douglasii*	n/a	No	Yes	No	Yes
Yellow toadflax *Linaria vulgaris*	1-100	Yes	–	No	Yes

[1] A Designated Noxious Weed listing provides the State of Wyoming legal authority to regulate and manage noxious weeds per the Wyoming Weed and Pest Control Act of 1973 (Wyoming Weed and Pest Council, 2007).
[2] A County Declared Weed listing provides the county with legal authority to regulate and manage noxious weeds. Source: Wyoming Weed and Pest Council, 2007.
[3] Potentially present in PAPA if present within the Pinedale Field Office Planning Area (BLM, 2007a) and Wyoming Cooperative Agricultural Pest Survey (2007).

3.18.2 Pipeline Corridors and Gas Sales Pipelines

Vegetation along the proposed corridor/pipeline alignments consists primarily of sagebrush steppe with a limited grassland component. Wetlands and riparian communities are present at locations where the alignments cross the New Fork, Green, and Blacks Fork rivers. Species composition and habitat types vary depending on soil type, salinity, exposure, and moisture levels. Precipitation is a limiting factor for vegetation in the Green River Basin and the vegetative communities are dominated by species that require little water and can exist on aridic soils.

The sagebrush steppe vegetative community is widely distributed within and along the proposed corridor/pipeline alignments and is most often associated with valley bottoms and plateaus. Sagebrush density and distribution vary from sparse low-structure sagebrush interspersed with grasses and forbs in the understory to areas more densely vegetated by sagebrush. The species that commonly occur in this community include basin big sagebrush, Wyoming big sagebrush, sand sagebrush, rubber rabbitbrush, black greasewood, prickly pear cactus, spiny hopsage, Indian ricegrass, needle-and-thread grass, and western wheatgrass.

Grassland communities along the proposed corridor/pipeline alignments are generally limited in size. They are principally found on existing pipeline rights-of-way. Small patches occur along the proposed alignments. Species vary by soil type and ground use history and include western wheatgrass, thickspike wheatgrass, Indian ricegrass, Sandberg bluegrass, and needle-and-thread grass. Wyoming big sagebrush, rabbitbrush, broom snakeweed, winterfat, and greasewood are common shrubs of this grass community.

Recently disturbed corridors from existing pipeline rights-of-way are susceptible to infestations of invasive/noxious weeds such as Canada thistle, musk thistle, black henbane, and halogeton (*halogeton glomeratus*). Field surveys in 2006 found that halogeton is present in many areas along the existing pipeline rights-of-way (Grasslands Consulting, Inc., 2006). Table 3.18-3 lists the declared weed species in Sublette, Sweetwater, Lincoln, and Uinta counties that are known or suspected to occur (Wyoming Weed and Pest Council, 2007).

Table 3.18-3
County Declared Species Known to Occur
in Sublette, Sweetwater, Lincoln, and Uinta Counties that may
Occur Along the Proposed Corridor/Pipeline Alignments

Common Name Scientific Name	Sublette County	Sweetwater County	Uinta County	Lincoln County
Black henbane *Hyoscyamus niger*	Present	Present	Present	
Scentless chamomile *Anthemis arvensis*	Present			
Field scabious *Knautia arvensis*	Present			
Western water hemlock *Cicuta douglasii*	Present			
Foxtail barley *Hordeum jubatum*	Present	Present		
Lady’s bedstraw *Galium verum*		Present		
Mountain thermopsis *Thermopsis Montana*		Present		
Yellow starthistle *Centaurea solstitialis*			Present	
Viper’s bugloss *Echium vulgare*			Present	
Wild oats *Avena fatua*				Present
Bull Thistle *Cirsium vulgare*	Present			Present

3.19 GRAZING RESOURCES

3.19.1 Development in the PAPA

There are 50 permittees on the 16 livestock grazing allotments that coincide with the PAPA (Map 3.19-1) and that were listed in the PAPA DEIS (BLM, 1999a). The BLM management categories for area allotments have not changed since the PAPA ROD was issued (BLM, 2003a); nor have there been changes to the grazing capacity (animal unit months or AUMs) since the PAPA DEIS (Schultz, 2006). Approximately 37,000 (maximum restriction) livestock are stocked within various allotments and various times during the annual cycle. Most livestock are cattle, although some permittees graze limited numbers of horses. There are approximately 165,738 allotted acres in the PAPA.

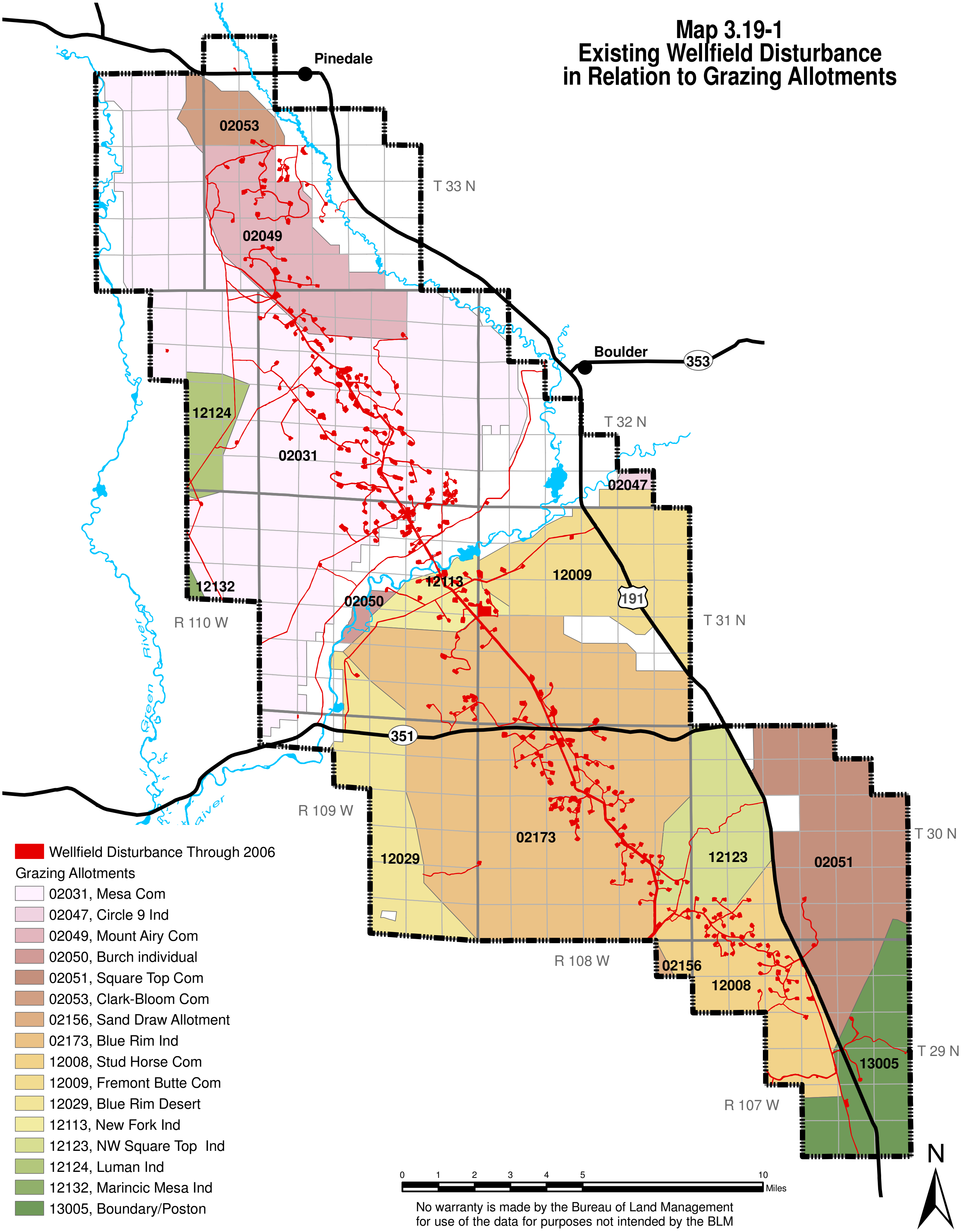
No revised or new allotment management plans have been initiated in the PAPA, although several range improvement projects have been implemented since 2000, including erosion control and water development. The BLM, permittees, and some Operators have coordinated several projects to provide better water sources for livestock. There have been multiple water development projects (wells, stock tanks, livestock reservoirs) in the various allotments in the PAPA. Many of those allotment improvements are shown on Map 3.20-1 and indicated as point locations included within the Wetland SRMZ.

The BLM has reported inadequate fencing around pits and tanks. Increased vehicular traffic has caused several livestock deaths and livestock have been accessing pits in the PAPA since the PAPA ROD (BLM, 2000b) was issued. Permittees have begun to use their own people to monitor and maintain oil and gas related activities/structures to protect their livestock and associated facilities.

The Mesa Common Allotment and Trapper's Point just to the north of the allotment, is a crucial area for "The Green River Stock Drift", a century-old seasonal stock driveway considered part of a potential Sublette County Rural Ranching Traditional Cultural Property and a potential Rural Historic Landscape. Increases in wellfield activities have led to increased incidences as they relate to grazing management, including loss/movement of stock watering locations, fence/gate/cattleguard issues, and disruption of over movement of The Green River Stock Drift. Increases in wellfield development have contributed to high levels of dust on some areas of forage plants (Schultz, 2006).

In 2003 and 2004, the BLM proposed a 25 percent reduction in PAPA allotment use because of drought (Section 3.3 and Table 3.3-1, Section 3.18.1, and Appendix 17, Wildlife Technical Report). The number of livestock grazing on BLM allotments was moderately reduced during that time (Schultz, 2006). In 2005, moisture levels and range conditions improved, and the 2005 grazing season returned to normal levels and permitted numbers.

The PAPA DEIS (BLM, 1999a) indicated that different allotments within the PAPA were capable of supporting varying levels of livestock according to estimates of the average area (acres) required to support one AUM, or acres per AUM. The most land to support one AUM was within the Marincic Mesa Individual Allotment (No. 12132), which averaged 16.92 acres per AUM. The least land to support one AUM was in the Luman Individual Allotment (No. 12124), which averaged 4.92 acres per AUM. With data for all allotments combined, the average area required to support one AUM for the entire PAPA is estimated to be 10.52 acres or an average of 0.095 AUM per acre.


Map 3.19-1
Existing Wellfield Disturbance
in Relation to Grazing Allotments
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
02053
02049
02031
12124
12132
02050
12113
12009
02047
02173
12029
12123
02051
02156
12008
13005
Wellfield Disturbance Through 2006
Grazing Allotments
02031, Mesa Com
02047, Circle 9 Ind
02049, Mount Airy Com
02050, Burch individual
02051, Square Top Com
02053, Clark-Bloom Com
02156, Sand Draw Allotment
02173, Blue Rim Ind
12008, Stud Horse Com
12009, Fremont Butte Com
12029, Blue Rim Desert
12113, New Fork Ind
12123, NW Square Top Ind
12124, Luman Ind
12132, Marincic Mesa Ind
13005, Boundary/Poston
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Grazing allotments in the PAPA have been affected to varying degrees by wellfield disturbance (Table 3.19-1 and Map 3.19-1). Before the PAPA ROD (BLM, 2000b) was issued, there had been relatively few surface disturbances within any single allotment. The allotments most affected since the PAPA ROD was issued are on the Anticline Crest.

As of November 2006, the amount of wellfield disturbance in all allotments was 4,356.5 acres (Table 3.19-1). Assuming an average of 0.095 AUMs per acre, this disturbed land would support 414 AUMs. Most surface disturbance in the PAPA that is not yet revegetated would be reclaimed, and so estimated loss of AUMs is a current condition that is expected to be temporary. The New Fork Individual Allotment has the most surface disturbance relative to its area within the PAPA; 11.5 percent of the surface area has been disturbed by wellfield activities since 2006 with most having occurred on federal lands (Table 3.19-1).

Table 3.19-1
Existing Wellfield Disturbance in Relation to Grazing Allotments

Allotment and Number	Surface Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Mesa Common (02031)	48,634	1,242.7	131.6	1,374.3
Circle 9 Individual (02047)	332	0.0	0.0	0.0
Mount Airy Common (02049)	10,004	428.7	0.3	429.0
Burch Individual (02050)	587	0.7	0.1	0.8
Square Top Common (02051)	14,293	31.1	0.0	31.1
Clark-Bloom Common (02053)	2,513	15.5	0.0	15.5
Sand Draw (02156)	160	0.0	0.0	0.0
Blue Rim Individual (02173)	40,028	1,172.2	198.2	1,370.4
Stud Horse Common (12008)	10,022	458.0	60.1	518.1
Fremont Butte Common (12009)	10,833	76.8	0.0	76.8
Blue Rim Desert (12029)	7,756	28.7	0.0	28.7
New Fork Individual (12113)	2,953	322.5	17.1	339.6
NW Square Top Individual (12123)	7,031	100.5	0.2	100.7
Luman Individual (12124)	2,710	7.9	0.0	7.9
Marincic Mesa Individual (12132)	164	0.0	0.0	0.0
Boundary/Poston (13005)	7,266	62.5	1.1	63.6
Total	**165,712**	**3,947.8**	**408.7**	**4,356.5**

3.19.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would cross portions of 13 grazing allotments within the PFO, RSFO, and KFO (Table 3.19-2). Most of these allotments are designated for use by sheep and cattle or by cattle only. Seasonal use varies among allotments. The proposed corridor/pipeline alignments may also cross some range improvements within these allotments, including fences and stock water facilities/pipelines.

Table 3.19-2
Grazing Allotments Potentially Crossed by the Proposed Corridor/Pipeline Alignments from North to South[1]

Allotment	Allotment Area (acres)	Allotment AUMs	Livestock Type	Season of Use
Mesa Common (2031)[2]	55,789	4,701	Cattle/horses	5/5-11/5 5/1-10/31
New Fork Individual (2113)[2]	1,850	302	Cattle	5/10-6/20
Blue Rim Individual (2173) [2]	36,585	3,258	Cattle	5/10-6/23
Sand Draw (2156)[2]	31,740	2,324	Cattle	5/1-6/26
Blue Rim Desert (2029)[2]	39,609	2,826	Cattle	5/1-6/21
South Desert (2040)[2]	34,564	2,621	Cattle	5/1-8/23
Figure Four (13023)[3]	114,425	6,644	Sheep/cattle	5/10-1/10
Eighteen-Mile (13017)[3]	228,840	18,994	Sheep/cattle	5/1-1/31
Lombard (13022)[2]	94,802	6,643	Sheep/cattle	5/1-1/31
Seedskadee (11112)[4]	12,555	298	Horse Sheep/cattle	All year 5/1-12/31
Slate Creek (11113)[4]	267,048	20,780	Sheep/cattle	4/15-11/30
Granger Lease (11302)[4]	467,059	20,430	Sheep/cattle	Dec-Apr/May-Oct

[1] Source: Schulz, 2006; D'Ewart, 2006, and Burgin, 2006.
[2] PFO.
[3] RSFO.
[4] KFO.

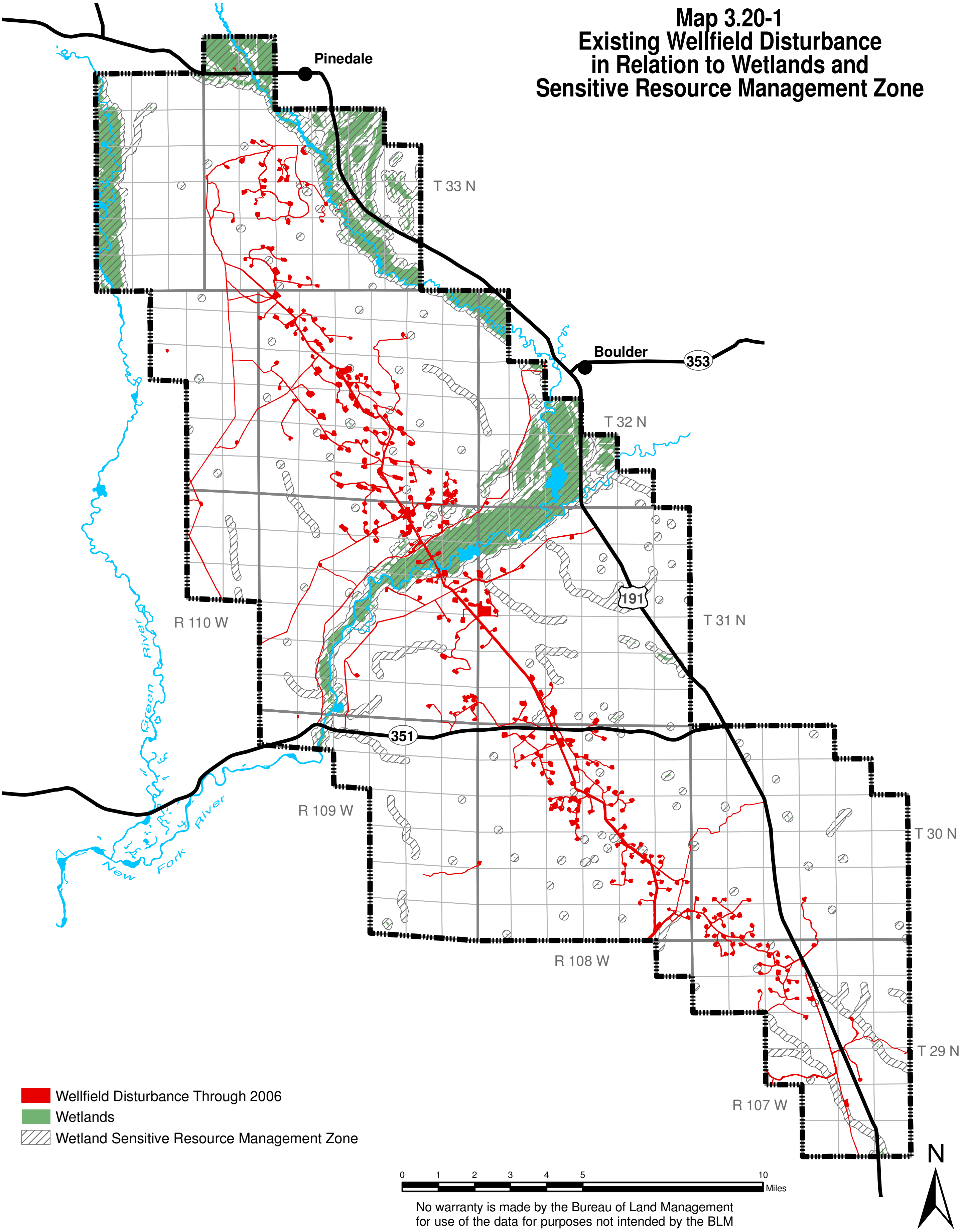
3.20 WETLANDS, RIPARIAN RESOURCES AND FLOOD PLAINS

3.20.1 Development in the PAPA

Wetlands are subject to protection under federal law and Executive Order 11990, regardless of land ownership. The EPA and COE use the following definition of wetland to administer the Clean Water Act's Section 404 permit program for dredge and fill activities: *those areas that are inundated or saturated by surface or groundwater 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* (40 CFR § 230.3 and 33 CFR § 328.3).

Wetlands have three essential characteristics: 1) hydrophytic vegetation; 2) hydric soils; and 3) wetland hydrology (BLM, 1999a). Riparian areas adjacent to perennial streams, such as the Green and New Fork rivers, usually contain willow and cottonwood communities, wet meadows, and irrigated fields that are all likely to exhibit wetland characteristics. Riparian areas adjacent to intermittent and ephemeral streams (Lovatt Draw, North Alkali Draw, Sand Draw, and Sand Springs Draw) may also contain wetlands where seasonal flows and high water tables are present. For reasons discussed in the PAPA DEIS (BLM, 1999a), all wetlands in the PAPA were identified as the Wetland SRMZ. Consistent with the BLM's policy to protect a 500-foot buffer from wetland boundaries, the Wetland SRMZ includes 500 feet from wetlands, including non-jurisdictional wetlands not subject to protection under 40 CFR § 230.3, 33 CFR § 328.3, and Executive Order 11990 (Map 3.20-1).

Wetlands include wet meadows and all irrigated hay fields and pastures above the New Fork River's flood plain that may not be jurisdictional wetlands. Most of the wetlands in the PAPA occur along the flood plains of the Green and New Fork rivers and most (96 percent) are on private and state lands. Because of agriculture and residential developments on private lands, the total area affected by various human-related disturbances to wetlands and the Wetland SRMZ before approval of the PAPA ROD (BLM, 2000b) was extensive. Since issuance of the



Map 3.20-1
Existing Wellfield Disturbance in Relation to Wetlands and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Wetlands
Wetland Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N

PAPA ROD (BLM, 2000b), the BLM is not aware of any well pad construction within wetlands (Gamper, 2007). Most disturbance has been due to pipeline and road construction. Because these are linear components, disturbance cannot be avoided.

In addition to the Wetland SRMZ, the 100-year flood plain, as identified by the Federal Emergency Management Agency, was determined to be the Flood Plain SRMZ (Map 3.20-2) in the PAPA DEIS (BLM, 1999a). The Sublette County Zoning and Development Regulations specifically address development in flood areas (Chapter III, Section 13). The County regulations define a floodway as *"that area of the county, including the channel of any water course, stream or river, required to effectively carry and discharge flood waters, that is inundated by the ten year recurrence interval flood."* The County's development standards prohibit the placement of any structures in any floodway. In flood areas, where groundwater level is within 4 feet of the surface, all structures and site improvements must be designed to minimize groundwater pollution or contamination. There are approximately 11,022 acres of land within the 100-Year Flood Plan and Flood Plain SRMZ. Of this, approximately 55.8 acres (10.1 acres on federal lands and minerals) have been disturbed as a result of wellfield activities. Most of this disturbance is due to construction of roads and pipelines.

3.20.2 Pipeline Corridors and Gas Sales Pipelines

Along the proposed corridor/pipeline alignments, wetlands are limited in extent and are only present along the river banks of the Blacks Fork and Green rivers and in the flood plain of the New Fork River at the proposed crossing locations. The wetlands are primarily expressed as emergent herbaceous vegetation consisting of sedges and rushes. The flood plain also supports forest-dominated riparian habitats with mostly willows and cottonwoods.

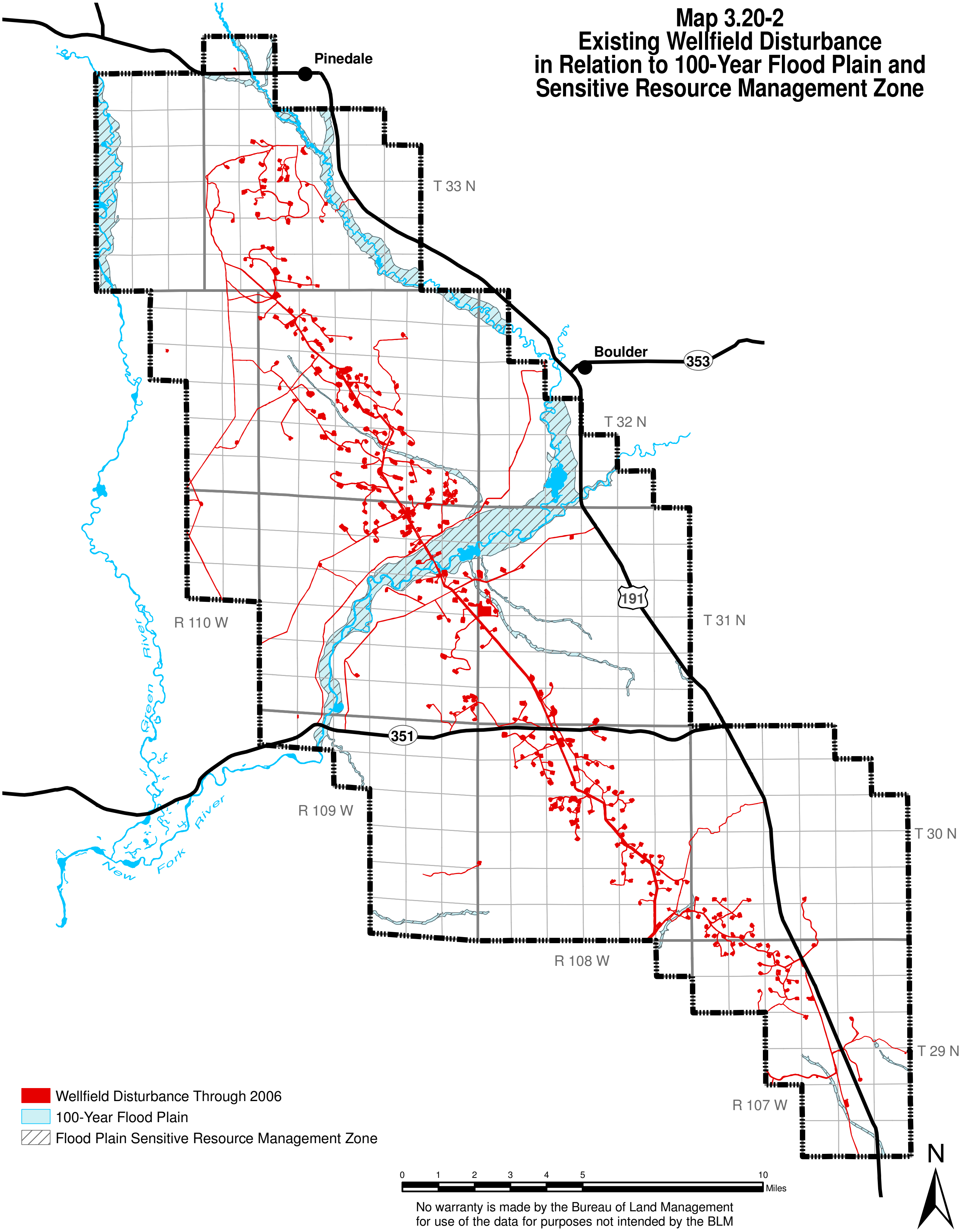
3.21 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

3.21.1 Development in the PAPA

3.21.1.1 Federally Listed, Proposed, and Candidate Species

At the time the PAPA DEIS (BLM, 1999a) was prepared, Ute ladies'-tresses orchid, black-footed ferrets, bald eagles, whooping cranes, and four species of Colorado River fish were species listed under the Endangered Species Act (ESA) that were considered potentially vulnerable to development in the PAPA. Canada lynx and mountain plover were species proposed for listing, and the swift fox was a candidate species for listing under the ESA. Since 2000, Canada lynx have been listed as threatened (USFWS, 2000) while the proposal to list mountain plovers as threatened was withdrawn (USFWS, 2003b). Swift fox is no longer considered to occur in the region.

In a written communication to the BLM, the USFWS (2005a and 2005b) identified the following species that could be affected by natural gas developments in the PAPA: black-footed ferret (endangered), Kendall Warm Springs dace (endangered), Colorado River fish (endangered), bald eagle (threatened), grizzly bear (threatened), Canada lynx (threatened), Ute ladies'-tresses orchid (threatened), and gray wolf (experimental population). As discussed below, bald eagles are no longer listed as threatened under the ESA. Although they were addressed in the PAPA DEIS (BLM, 1999a), whooping cranes (endangered) are not included because the last surviving crane in the population died in 2002 (Whooping Crane Conservation Association, 2004). There are other species that are candidates for listing (yellow-billed cuckoos), and species that the USFWS (2005a) identified as sensitive (greater sage-grouse and pygmy rabbit).



Map 3.20-2
Existing Wellfield Disturbance
in Relation to 100-Year Flood Plain and
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
100-Year Flood Plain
Flood Plain Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Black-footed Ferret. Historical evidence suggests that black-footed ferrets occurred in the Green River Basin. Ferrets are closely associated with prairie dog colonies, like those in sagebrush-grasslands (Cerovski et al., 2004). The USFWS (2004a) evaluated the potential for prairie dog colonies in Wyoming to support black-footed ferrets. The USFWS determined that many areas in the state are not likely to be inhabited by the species, based on habitat quality and the likelihood that ferrets, if ever they were present, are now extirpated. The USFWS (2004a) determined that approximately 64 square miles of the PAPA (all or portions of T. 29-31 N. and R. 109-111 W.) are within the Big Piney Prairie Dog Complex, in which surveys for black-footed ferrets are recommended. The remainder of the PAPA has been cleared for further need to conduct surveys for the species (FWS, 2004a). An old black-footed ferret skull was located in 2007 during surveys conducted for burrowing owls within T. 31 N., R. 109 W. Identification of the skull was verified by the USFWS.

Kendall Warm Springs Dace. This species is restricted to Kendall Warm Springs, an aggregation of thermal seeps and springs that eventually flow into the Green River. The population is limited to approximately 980 feet of pools and stream segment, all within the Bridger-Teton National Forest (USFWS, 1982), approximately 30 miles north of Pinedale.

Colorado River Fish. The USFWS (2005b) has indicated that the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker may inhabit the Colorado River System downstream from the PAPA in the Green River. Prior to construction of Flaming Gorge Reservoir, populations of pikeminnows and bonytails may have been viable in the Green River, although they are now extirpated (Baxter and Stone, 1995).

Bald Eagle. The USFWS proposed to remove the bald eagle from the list of endangered and threatened wildlife in 1999 because the bald eagle's population growth had exceeded most goals established in various recovery plans (USFWS, 1999). The USFWS reopened the public comment period on February 16, 2006 (USFWS, 2006a), and on August 8, 2007, the bald eagle was delisted (USFWS, 2007b). Although no longer listed as threatened under the ESA, bald eagles remain protected under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d) and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712). The BGEPA prohibits "take" of bald and golden eagles, which includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest, or disturb (50 CFR § 22.3). The USFWS defines "disturb" as "to agitate or bother a bald or golden eagle to the degree that it interferes with or interrupts normal breeding, feeding, or sheltering habits, causing injury, death, or nest abandonment" (USFWS, 2006b). The BLM in Wyoming will follow State guidance (IM WY-2007-037 – BLM, 2007b) during the interim period, until the USFWS develops a process to allow for "take" of bald eagles under the BGEPA. The guidance states, "Wyoming BLM will continue to apply protective measures (terms and conditions) found in the Statewide Bald Eagle Programmatic Biological Opinion (BO – USFWS, 2004b) or other valid BOs to safeguard bald eagles and their nesting and roosting habitats when authorizing various actions. Pinedale BLM will follow the *New Fork and Green Rivers within the Pinedale Anticline Oil and Gas Exploration and Development Project Area Biological Opinion* (New Fork and Green Rivers BO - USFWS, 2007c). Bald eagles nesting in northwest Wyoming have been increasing steadily since 1978 (Patla et al., 2003). Bald eagles nest in trees, including cottonwoods, and in riparian zones associated with large lakes and streams (Cerovski et al., 2004).

Wintering bald eagles regularly occur in western Wyoming, generally from November 1 through April 15 (USFWS, 2005a), and may occur during any time of year along the Green River corridor. Observations of bald eagles and other wintering birds are reported by the Audubon Society's Christmas Bird Counts. These counts were made near the PAPA during December 1984 and 1987, and only one bald eagle was reported in each year. Migratory bald eagles have been observed during April and November generally throughout the Green River Basin (Patla, 2004), which is also potential bald eagle nesting and roosting habitat. Bald eagles arrive on the Green River the second week of October, coinciding with kokanee salmon and brown trout spawning, which are probably a primary source of autumn food (BLM, 1995).

During February 2005, the BLM conducted a winter ground survey of bald eagles in the PFO Administrative Area. A total of 54 eagles were counted, most of them along the Green River and its tributaries, although 10 eagles were documented along the New Fork River between Boulder and its confluence with the Green River. Most bald eagle observations during surveys were associated with forest-dominated riparian cover. During the February 2006 survey, eight bald eagles were documented along the New Fork River. In winter 2007, 16 bald eagles were observed in the vicinity of the PAPA along the New Fork River and Green River.

In 2004 and 2005, there were two active bald eagle nests in the PAPA, each producing two young (Patla, 2005). Both nests were active again in 2006 with adults incubating during early April (Patla, 2006). One of the nests was discussed in the PAPA DEIS (BLM, 1999a) and was active in 1999. Early in the 2007 nesting season, there were five bald eagle nests occupied by adults within the PAPA or within 1 mile of the PAPA boundary. A total of five young eagles fledged from only two of the nests; two nests produced no young; and one of the occupied nests was apparently abandoned by the adult(s) prior to initiating nesting activity (Patla, 2007).

In Wyoming, bald eagle eggs hatch around May 1, and young fledge about July 10 (Johnsgard, 1986). However, nest building may be initiated during February (Call, 1978 and USFWS, 2005a). Fledged juvenile bald eagles may remain in the nest vicinity for a month, often through August (Isaacs et al., 1983 and USFWS, 2005a).

Since the issuance of the PAPA ROD (BLM, 2000b), one well pad was constructed within 1 mile of one of the bald eagle nests in 2004. In addition, 17 miles of road and 12.5 miles of pipeline were constructed within 1 mile of the two nests. Prior to July 2000, however, there had been considerable surface disturbance within 1 mile of both nest sites, primarily due to agricultural facilities, residences, and roads (Table 3.21-1). U.S. Highway 191 is within 1 mile of one nest and the Boulder South Road is within 1 mile of the other. Before July 2000, eleven well pads had been constructed within 1 mile of bald eagle wintering habitat along the New Fork River riparian zone. Since then, 29 additional well pads have been constructed within that 1 mile zone. There has been a total of 172 acres of wellfield disturbance within 1 mile of the bald eagle nests that were occupied in 2007. The majority of this disturbance has been on federal lands (Table 3.21-1). By November 2006, a total of 716.1 acres had been disturbed by wellfield activities within 1 mile of the New Fork River riparian zone and 10.7 acres had been disturbed in forest-dominated riparian vegetation (Table 3.21-1).

Table 3.21-1
Existing Wellfield Disturbance in Relation to 1-Mile Buffer of Bald Eagle Habitats

Habitat Component	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
1 mile of Occupied Bald Eagle Nests	4,000	114.8	57.6	172.4
1 mile of New Fork River Riparian Zone	38,160	509.8	206.3	716.1
Forest-Dominated Riparian Vegetation	4,036	1.1	9.6	10.7

Grizzly Bear. The entire PAPA is outside the outer boundary for grizzly bear occupancy established in the Wyoming Grizzly Bear Management Plan (Moody et al., 2002). In the plan, the WGFD's policy is to limit bear occurrence outside of the boundary, with the intent to exclude them from becoming reestablished in other areas of the state.

The grizzly bear has a wide range of habitat tolerance. The preferred habitat for grizzly bears is typically contiguous, relatively undisturbed mountainous habitat with a high topographic gradient and vegetative diversity. Among other food sources, grizzlies feed on winter-killed big game carrion, often encountered on big game winter ranges, including those in the PAPA. Otherwise, suitable habitat for the species is not present in the PAPA.

Canada Lynx. A reproducing population of Canada lynx has been documented near Merna where they prey on snowshoe hares (Laurion and Oakleaf, 1998). Lynx are generally associated with dense coniferous forests (Englemann spruce-subalpine fir) at high elevations (Cerovski et al., 2004). Suitable habitats for lynx are not present in the PAPA.

Ute Ladies'-tresses Orchid. Except for its possible occurrence along the Green River, this species was not addressed in the PAPA DEIS (BLM, 1999a). Examination of the location revealed unsuitable habitat. Ute ladies'-tresses orchid was listed as threatened in 1992 (USFWS, 1992). In Wyoming, Ute ladies'-tresses orchid have been located on old oxbows or flood plain terraces associated with small streams on sites that remain moist (meadow plant communities) throughout the summer, either due to seasonal flooding or sub-irrigation (Fertig, 2000). All four of the known populations in Wyoming occur in the eastern half of the state. Searches were conducted in western Wyoming (Jackson Hole, National Elk Refuge, and Green River Basin) during the 1990s (Fertig, 2000). Given the elevation ranges and precipitation regimes associated with site occurrence, the species' presence within the PAPA is unlikely. The USFWS (2004c) is undertaking a 5-year status review of Ute ladies'-tresses orchid to determine if delisting the species is warranted.

Gray Wolf. Since the reintroduction of 31 animals in Yellowstone National Park (YNP) during 1995 and 1996, the gray wolf population in the Greater Yellowstone Recovery Area during 2003 included approximately 89 animals in Wyoming inhabiting areas outside of YNP (USFWS et al., 2004). By 2005, there were 134 wolves in Wyoming outside of YNP and 252 wolves in the state's portion of the Greater Yellowstone Recovery Area (USFWS et al., 2006). The animals are classified as a nonessential experimental population (USFWS, 2005a). Gray wolves inhabit coniferous forests as well as shrub and grasslands in mountains and foothills, where they feed on big game and smaller prey species (Cerovski et al., 2004).

Packs have become established outside of YNP including two packs near the PAPA: the Green River Pack east of the PAPA in the upper Green River Basin in 2002, and the Daniel Pack northwest of the PAPA in 2003 (USFWS et al., 2004). Since their establishment, both wolf packs have preyed on cattle and sheep and pack members in both packs have been killed in control actions. Wolves in the Daniel pack continued to kill livestock through 2005 and the USFWS authorized that all wolves in the pack be killed. Six wolves from the pack were shot in December 2005 but two others escaped; the pack became reestablished in 2006 (USFWS et al., 2007). Other wolves dispersed to the Pinedale/Cora area and were subsequently killed after repeated livestock depredations (USFWS et al., 2005). There were five wolves reported in the Pinedale/Cora area in 2006 (USFWS et al., 2007). In 2006, a total of 22 wolves had been killed by federal officials in Sublette County, including the last adult member of the Green River Pack and members of a pack that had become established near Prospect Mountain, east of Farson. The USFWS authorized removal of the pack. Five wolves were killed in 2006 after 22 depredations on cattle but several pack members without radio collars could not be located (USFWS et al., 2007).

During winter 2002-2003, wolves killed two elk (both in the Pinedale Elk Herd Unit) on two of the three elk wintering feedgrounds: Fall Creek and Scab Creek (Clause, 2004a). Wolves killed 16 elk on the Black Butte and Soda Lake feedgrounds within the Green River Elk Herd Unit during 2003 (Clause, 2004b). Although portions of both elk herd units coincide with the PAPA, only the northern portion coincides with the winter range utilized by elk in the Green River Herd Unit. While unlikely, wolves could potentially be present near the PAPA.

Yellow-billed Cuckoo. This species was petitioned for listing in 1998. Following a status review, the USFWS (2001) found that listing the western distinct population segment of yellow-billed cuckoos (including those in Wyoming) as threatened was warranted but precluded and the species is currently a candidate for listing (USFWS, 2005a). The species is found in eastern Wyoming where it is associated with deciduous woods and thickets along riparian zones (Dorn and Dorn, 1990 and Cerovski et al., 2004).

No yellow-billed cuckoos have been documented in the upper Green River Basin, although breeding may have occurred southeast of the basin (Cerovski et al., 2004). There are nine National Biological Survey Breeding Bird Survey (BBS) routes in the upper Green River area. Although some of these routes have been surveyed since 1980, none have continuous records. Yellow-billed cuckoos have not been reported in any of the surveys in the PAPA vicinity. Further, BBS routes in 2002 on BLM-administered public lands that included the PAPA did not detect the species (McGee et al., 2002).

3.21.1.2 Sensitive Species in the PAPA

Greater Sage-Grouse. The eastern subspecies of greater sage-grouse was petitioned for listing as endangered in 2002. Wyoming is included in the subspecies' range. However, the USFWS determined that evidence was lacking to distinguish the eastern subspecies as a valid subspecies, and therefore it is not a distinct population segment applicable under the ESA (USFWS, 2004d). A similar evaluation was rendered on a petition to list the western subspecies in 2003.

The USFWS completed a status review of the greater sage-grouse and determined that it does not warrant protection under the ESA throughout its range, including Wyoming (USFWS, 2005c); however, in a recent ruling, a U.S. District Judge in Boise, Idaho stated that the USFWS must reconsider whether greater sage-grouse should be listed as an endangered species. Greater sage-grouse are managed as an upland game bird in Wyoming and the species is discussed in Section 3.22.1.2. Greater sage-grouse leks, wintering grounds, and nests have been documented within the PAPA.

Pygmy Rabbit. Pygmy rabbits in Washington's Columbia Basin were listed as endangered in 2003 (USFWS, 2003c) but that listing does not apply to the species in Wyoming. Pygmy rabbits have been designated as a sensitive species by the BLM (BLM, 2002) as well as by the USFWS (2005a). Pygmy rabbits use subspecies of sagebrush and other shrub species (bitterbrush, rabbitbrush, greasewood, snowberry, and juniper) that may be present (Ulmschneider et al., 2004). Burrows are usually hidden under sagebrush. Characteristic pygmy rabbit habitat includes drainages with dense, tall sagebrush. Pygmy rabbits burrow in loamy soils, deeper than 20 inches. Soil composition needs to be able to support a burrow system with numerous entrances and it needs to be soft enough for digging.

Wyoming's pygmy rabbit habitat includes uncharacteristic areas (Wyoming Wildlife Consultants LLC., 2006 and Ulmschneider et al., 2004). In the PAPA, pygmy rabbits have been observed in characteristic (McGee et al., 2002) and uncharacteristic habitats, such as flat areas with short sagebrush (Wyoming Wildlife Consultants LLC, 2006). Often, they are associated with soil mounds near sagebrush. Such mounds can become entire burrowing systems. Pygmy rabbits occur throughout the PAPA (especially on the Mesa) and in the Jonah Field Project Area. The extent of their presence outside these areas is unknown (Wyoming Wildlife Consultants LLC, 2006 and Purcell, 2005). Over 30 pygmy rabbit sightings and over 200 burrows were documented in the PAPA in 2005.

Other Special Status Species. In addition to species listed under the ESA, the BLM has identified sensitive species (BLM, 2002) in the Pinedale and Rock Springs resource areas, some of which are known to occur or potentially occur in the PAPA. The BLM developed a formal sensitive species list after the PAPA ROD (BLM, 2000b) was issued. BLM-sensitive species known to occur in or near the PAPA include: ferruginous hawk, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and white-tailed prairie dog (McGee et al., 2002). River otters were documented in the New Fork River during the 1980's (Rudd et al., 1986). Other species' occurrences, listed in Table 3.21-2, are judged as possible, unlikely, or highly unlikely based on their habitat requirements and known distributions (Baxter and Stone, 1980; Baxter and Stone, 1995; McGee et al., 2002; and Cerovski et al., 2004).

Table 3.21-2
BLM-Sensitive Fish and Wildlife Species and WGFD Species of Special Concern Not Listed Under ESA that could Occur in the PAPA, Habitats, and Other Status Designations[1]

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Fish				
Roundtail chub *Gila robusta*	Colorado River drainage in large rivers, streams and lakes	possible	S3	NSS1
Leatherside chub *Gila coperi*	Green River drainage in clear, cool streams and pools	highly unlikely	S1	NSS1
Bluehead sucker *Catostomus discobolus*	Green River drainage, all water types	possible	S3	NSS1
Flannelmouth sucker *Catostomus latipinnis*	Colorado River drainage in large rivers, streams and lakes	present	S3	NSS1
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*	Colorado River drainage, clear mountain streams	unlikely	S1	NSS2
Amphibians				
Northern leopard frog *Rana pipiens*	Beaver ponds, permanent water in plains and foothills	possible	S3	none
Columbia spotted frog *Rana pretiosa*	Ponds, sloughs, small streams	unlikely	S3	none
Western boreal toad *Bufo boreas boreas*	Pond margins, wet meadows, riparian areas	possible	S1	none
Birds				
Snowy egret *Egretta thula*	Marshes, lakes, rivers	possible	S3B	NSS3
White-faced ibis *Plegadis chihi*	Marshes, wet meadows	possible	S1B	NSS3
Forster's Tern *Sterna forsteri*	Marshes, estuaries, lakes, reservoirs	highly unlikely	S1	NSS3
Black Tern *Chliodonias niger*	Marshes	unlikely	S1	NSS3
Trumpeter swan *Cygnus buccinator*	Lakes, ponds, rivers	possible	S2	NSS2
Northern goshawk *Accipiter gentiles*	Conifer and deciduous forests	highly unlikely	S3	NSS4
Merlin *Falco columbarius*	Coniferous or deciduous trees	present	S4	NSS3
American peregrine falcon *Falco pereginus anatum*	Cliffs in most habitats near lakes and rivers	possible	S3	NSS3
Ferruginous hawk *Buteo regalis*	Basin-prairie shrub, grasslands, rock outcrops	present	S5N	NSS3
Greater sage-grouse Centrocercus urophasianus	Basin-prairie shrub, mountain-foothills shrub	present	S4	game bird
Mountain plover *Charadrius montanus*	Grasslands	present	S2	NSS4
Long-billed curlew *Numenius americanus*	Grasslands, plains, foothills, wet meadows	possible	S3B	NSS3

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Yellow billed cuckoo *Coccyzus americanus*	Open woodlands, streamside willow and alder groves	highly unlikely	S1	NSS2
Burrowing owl *Athene cunicularia*	Grasslands, basin-prairie shrub	present	S3	NSS4
Great gray owl *Strix nebulosa*	Coniferous forests, aspen, mountain-foothills grassland	unlikely	S2	NSS4
Lewis's Woodpecker *Melanerpes lewis*	Open riparian woodland, cottonwood, mixed conifer	possible	S2	NSS3
Loggerhead shrike *Lanius ludovicianus*	Basin-prairie shrub, mountain-foothills shrub	possible	S3	none
Sage thrasher *Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothills shrub	present	S5	NSS4
Grasshopper sparrow *Ammodramus savannarum*	Basin-prairie shrub, wet meadow, grasslands	possible	S4	NSS4
Brewers sparrow *Spizella breweri*	Basin-prairie shrub	present	S5	NSS4
Sage sparrow *Amphispiza belli*	Basin-prairie shrub, mountain-foothills shrub	present	S3	NSS4
Mammals				
Dwarf shrew *Sorex nanus*	Mountain-foothills shrub	unlikely	S4	NSS3
Fringed myotis *Myotis thysanodes*	Coniferous forest, woodland, prairie-basin shrub	possible	S2	NSS2
Long-eared myotis *Myotis evotis*	Conifer and deciduous forests, caves and mines	possible	S4	NSS2
Spotted bat *Euderma maculatum*	Desert sagebrush-grasslands	possible	S3	NSS2
Townsend's Big-eared Bat *Corynorhinus townsendii*	Basin-prairie and mountain-foothills shrub, desert grasslands	unlikely	S2	NSS2
Pygmy rabbit *Brachylagus idahoensis*	Prairie-basin shrub and riparian shrub	present	S1	NSS3
White-tailed prairie dog *Cynomis leucurus*	Grasslands, basin-prairie shrub	present	S3	NSS3
Idaho pocket gopher *Thomomys idahoensis*	Shallow stony soils	highly unlikely	S2	NSS3
River Otter *Lutra Canadensis*	Riparian areas, burrows, caves	present	S3	NSS4

[1] Source: BLM, 2002; Keineth et al., 2003 and Cerovski et al., 2004.
[2] State Rank: Assigned by WYNDD and reflects status of species within political borders of Wyoming: S1 = Extremely rare, S2 = Very rare, S3 = Rare, S4 = Apparently secure, but may be rare in portions of its range, S5 = Secure under present conditions. "B" following state rank indicates breeding status; "N" indicates non-breeding status.
[3] WGFD Status = Wyoming Game and Fish Department Status:
NSS1 = Species with ongoing significant habitat loss, populations greatly restricted or declining, and extirpation appears possible.
NSS2 = Species 1) whose habitat is limited or vulnerable, but no recent or significant loss has occurred and populations are greatly restricted or declining; or 2) with ongoing significant loss of habitat and populations are declining or restricted in numbers and distribution, but extirpation is not imminent.
NSS3 = Species in which 1) habitat is not limited, but populations are greatly restricted or declining and extirpation appears possible; 2) habitat is limited or vulnerable, although no significant recent loss has occurred and populations are declining or restricted in numbers or distribution, but extirpation is not imminent; or 3) significant habitat loss is ongoing, but the species is widely distributed and population trends are thought to be stable.
NSS4 = Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted -OR- Populations declining or restricted in numbers or distribution, extirpation not imminent; Species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance -OR- Populations stable or increasing and not restricted in numbers or distribution; on-going significant loss of habitat.

Species of Special Concern, that are managed by the WGFD and may inhabit the PAPA, are listed in Table 3.21-2. Two of the species that are not BLM-sensitive, but which are present in the PAPA, are mountain plover and merlin. Observations of mountain plovers and merlins, as well as burrowing owls, have been made on or in the immediate vicinity of the PAPA since 2001, and their status in relation to wellfield development is under investigation (Ecosystem Research Group, 2006).

The BLM (2007c) has indicated that the following special status plant species may occur within the Pinedale Resource Area and, based on their habitat associations, are likely to occur in the PAPA: large-fruited bladderpod, Beaver Rim phlox, and tufted twinpod (Table 3.21-3). Meadow pussytoes, Trelease's racemose milkvetch, Cedar Rim thistle, and Big Piney milkvetch could occur if suitable habitats are present.

Table 3.21-3
BLM-Sensitive Plant Species Not Listed Under ESA that could Occur in the PAPA, Habitats, and Other Status Designations[1]

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]
Meadow pussytoes Antennaria arcuata	Moist, hummocky meadows, seeps or springs surrounded by sage/grasslands 4,950-7,900 feet elevation	possible	S2
Trelease's racemose milkvetch *Astragalus racemosus* var. *treleasei*	Sparsely vegetated sagebrush on shale or limestone outcrops, barren clay slopes, 6,500-8,200 feet elevation	possible	S2
Cedar Rim thistle *Cirsium aridum*	Barren, chalky hills, gravelly slopes, fine textured sandy-shaley draws, 6,700-7,200 feet elevation	possible	S2
Large-fruited bladderpod *Lesquerella macrocarpa*	Gypsum-clay hills, benches, clay flats, barren hills, 7,200-7,700 feet elevation	likely	S2
Payson's bladderpod *Lesquerella paysonii*	Rocky slopes, ridges, flood plains, and disturbed roadsides; 5,500 to 10,600 feet elevation	unlikely	S3
Beaver Rim phlox *Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, limestone substrates, 6,000-7,400 feet elevation	likely	S2
Tufted twinpod *Physaria condensate*	Sparsely vegetated shale slopes, ridges, 6,500-7,000 feet elevation	likely	S2
Swallen Mountain ricegrass *Achnatherum (Oryzopsis) swallenii*	Rocky slopes and rims, sandy to gravely limey-clay soils, grael covered; 6,500 to 7,900 feet elevation	unlikely	S2
Big Piney milkvetch *Astragalus drabelliformis*	Sandstone, stony clay, badlands, barren clay slopes and ridges; 6,900 to 7,200 feet elevation	possible	S2

[1] Sources: BLM, 2002 and Keinath et al., 2003.
[2] State Rank: assigned by WYNDD and reflects status of species within political borders of Wyoming:
S1 = Extremely Rare
S2 = Very Rare
S3 = Rare
S4 = Apparently secure, but may be rare in portions of its range
S5 = Secure under present conditions.

3.21.2 Pipeline Corridors and Gas Sales Pipelines

Special status species potentially occurring along the proposed corridor/pipeline alignments include the same federally-listed species as those identified as having the potential to occur in the PAPA. No suitable habitats are present within the proposed corridor/pipeline alignments corridors for Kendall Warm Springs dace, Canada lynx, grizzly bear, and gray wolf. Occurrences of black-footed ferrets and Ute ladies'-tresses orchid are possible, but unlikely. Bald eagles are likely to occur within riparian zones associated with the Green River and New

Fork River. Colorado River fish have been extirpated from the Green River, although they occur downstream in the Colorado River drainage. Greater sage-grouse and pygmy rabbits are likely to occur along portions of the proposed corridor/pipeline alignments.

All BLM-sensitive fish, wildlife, and plant species identified in Table 3.21-2 and Table 3.21-3 that could occur in the PAPA may also occur along the proposed corridor/pipeline alignments. Several additional BLM-sensitive species, identified by the BLM RSFO and KFO that could occur along the proposed corridor/pipeline alignments are listed in Table 3.21-4.

Table 3.21-4
BLM-Sensitive Fish, Wildlife, and Plant Species that could Occur in the Vicinity of the Proposed Corridor/Pipeline Alignments (in addition to those in Table 3.21-2 and Table 3.21-3)

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Wildlife				
Great Basin spadefoot *Spea intermontana*	Springs, seeps, temporary and permanent waters	unlikely	S3	none
Midget faded rattlesnake *Crotalus viridis concolor*	Mountain foothills shrub and rock outcrops in southwestern Wyoming and adjacent Colorado and Utah	highly unlikely	S1	none
Swift Fox *Vulpes velox*	Open prairies and arid grasslands, including areas intermixed with winter wheat fields	highly unlikely	S2	NSS4
Plants				
Mystery wormwood *Artemisia biennis var. diffusa*	Only known site is in Sweetwater County along clay flats and playas at 6,500 feet	highly unlikely	S1	none
Precocious milkvetch *Astragalus proimanthus*	Cushion plant communities on rocky, clay soils mixed with shale on summits and slopes of white shale hills from 6,800-7,200 feet	highly unlikely	S1	none
Nelson's milkvetch *Astragalus nelsonianus*	Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, and cushion plant communities from 5,200 to 7,600 feet	unlikely	S2	none
Small rock cress *Boechera (Arabis) pusilla*	Cracks and crevices in sparsely vegetated granite/pegmatite outcrops in sagebrush-grasslands around 8,000 feet	highly unlikely	S1	none
Ownbey's thistle *Cirsium ownbeyi*	Sparsely vegetated shaley slopes in sage and juniper communities between 6,440-8,400 feet	highly unlikely	S2	none
Wyoming tansymustard *Descurainia torulosa*	Sparsely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone from 8,300-10,000 feet	highly unlikely	S1	none
Entire-leaved peppergrass *Lepidium integrifolium* var *integrifolium*	Sparsely vegetated and seasonally wet clay flats, greasewood communities on clay hummocks, and moist alkaline meadows at 6,200-6,770 feet	highly unlikely	S1	none
Prostrate bladderpod *Lesquerella prostrate*	Plains, hills, and slopes in sagebrush, grass, and juniper communities in Lincoln and Uinta counties in the Muddy and Upper Bear River Mountains	highly unlikely	S1	none
Stemless beardtongue *Penstemon acaulis* var *acaulis*	Cushion plant or black sage grassland communities on semi-barren rocky ridges, knolls, and slopes at 5,900-8,200 feet	highly unlikely	S1	none
Dorn's twinpod *Physaria dornii*	Lincoln and Uinta counties in the Blacks Fork and Muddy drainages on dry, sparsely vegetated, calcareous-shaley slopes and ridges dominated by mountain mahogany and rabbitbrush	highly unlikely	S1	none

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Persistent sepal yellowcress *Rorippa calycina*	Sandy, muddy streambanks, stockponds, reservoirs 3,660-6,800 feet elevation	unlikely	S2S3	none
Green River greenthread *Thelesperma caespitosum*	Occurs along white shale slopes and ridges of the Green River Formation at 6,300 feet	highly unlikely	S1	none-
Uinta greenthread *Thelesperma pubescens*	Sweetwater and Uinta counties in the Upper Green-Flaming Gorge Reservoir and Blacks Fork rivers on very windy rims of extremely coarse-cobbly soils of the Bishop Conglomerate	highly unlikely	S1	none
Cedar Mountain Easter-daisy *Townsendia microcephala*	Sweetwater and Uinta counties in the Blacks Fork drainage on rocky slopes and cobbly ridges of the Bishop Conglomerate	highly unlikely	S1	none

[1] State Rank is the same as defined in Table 3.21-2 (vertebrates) and Table 3.21-3 (plants).
[2] WGFD status is the same as defined in Table 3.21-2.

3.22 WILDLIFE AND AQUATIC RESOURCES

3.22.1 Development in the PAPA

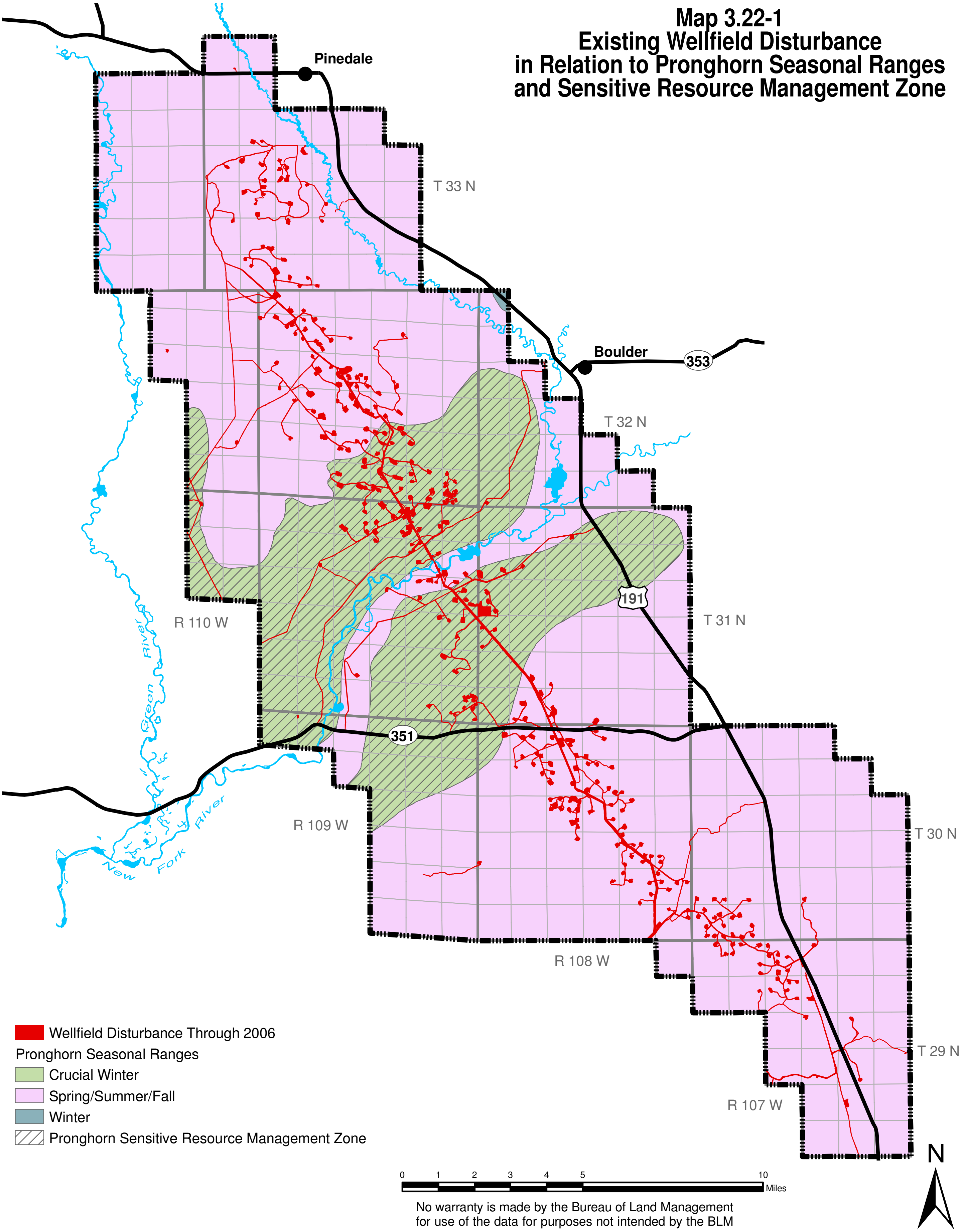
Wildlife habitats and their functions in the PAPA, including wintering, breeding, and nesting habitats, were described in detail in the PAPA DEIS (BLM, 1999a) and supporting documents. Since 2000, there have been several wildlife studies that have provided information that was unavailable when the PAPA ROD (BLM, 2000b) was issued. Some of the new information is presented in the sections below. Further, WGFD (2004a) has developed guidance relevant to current and future natural gas development in the PAPA: *Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats.* WGFD updated the document in 2007 although the latest edition has not been approved for release by the Wyoming Game and Fish Commission.

3.22.1.1 Big Game

Pronghorn. The PAPA covers several seasonal ranges utilized by pronghorn in the Sublette Herd Unit (Map 3.22-1). Winter ranges in the PAPA are occupied by pronghorn that migrate from distant summer ranges in Grand Teton National Park (GTNP) and Bridger-Teton National Forest (BTNF). Animals captured and equipped with radio telemetry collars may begin migrating to the PAPA as early as October in some years, or as late as December in others, taking approximately 1 month to complete the trip (Sawyer and Lindzey, 2000).

To reach the PAPA, pronghorn summering in GTNP and BTNF must travel 50 to 80 miles while crossing numerous obstacles, including 47 fences, several highways (including U.S. Highway 191), rivers (Upper Green River and Gros Ventre River), and must pass through proliferating housing subdivisions with associated fences and roads (Sawyer and Lindzey, 2000). One migratory passage of particular concern is a bottleneck in the vicinity of Trappers Point (not shown on Map 3.22-1). The bottleneck is north of the PAPA and is constricted to a 0.5-mile wide zone by the convergence of U.S. Highway 191, State Highway 352, riparian zones of the Green River and New Fork River, and private lands that have been subdivided, developed, and

Map 3.22-1
Existing Wellfield Disturbance in Relation to Pronghorn Seasonal Ranges and Sensitive Resource Management Zone



fenced (Sawyer and Lindzey, 2000). In 2003, over 21 miles of highway right-of-way fencing was modified to provide better passage for migratory big game (WGFD, 2004b). In 2005, WDOT installed roadside sensors along a 2-mile portion of U.S. Highway 191 that coincides with big game migrations through the Trappers Point Bottleneck. When the sensors detect animal presence, they activate flashing warning signs to alert motorists that large animals are likely to be on the highway. The system, when functional, has successfully detected big game on the highway though it is currently being upgraded (Maxam, 2006).

In the vicinity of this migration corridor constriction, the Trappers Point Bottleneck (Sawyer and Lindzey, 2000), the average daily traffic volume on U.S. Highway 191 at about milepost 100 increased from 3,000 vehicles (230 trucks)/24 hours in 2000 to 5,300 vehicles (340 trucks)/24 hours in 2005 (see Table 3.6-2). Pronghorns have been killed by vehicles along U.S. Highway 191 and State Highway 351 although data collected by WDOT (Carpenter, 2006) has not shown a trend of mortality related to traffic volume. In 2006, at least 12 pronghorns were killed on U.S. Highway 191 between Daniel Junction and the border with Sweetwater County while at least 13 were killed on the entire length of State Highway 351 (Carpenter, 2007). Carcass counts on both highways were higher in 2006 than during the previous two years.

Pronghorn returning to GTNP may begin moving in April or earlier, depending on snow conditions (Sawyer and Lindzey, 2000). Pronghorn movements from crucial winter ranges on the southern slopes of the Mesa begin by shifting their distribution to the top of the Mesa, subsequently continuing north on the top and western edge of the Mesa (Sawyer and Lindzey, 2000).

Long-term fawn production data (1978 to 2003) indicate an overall significant decline in the numbers of fawns per doe counted before harvest (BLM, 2004a). However, fawn production increased from 0.60 fawns per doe in 2003 to 0.74 fawns per doe in 2004 then declined in 2005 and 2006 (Table 3.22-1). The population decreased to 42,460 animals in 2004, partially due to low fawn production the year before (Frost, 2006). Conversely, the population increased in 2005 due to higher fawn production in 2004 (Table 3.22-1), probably as a result of increased precipitation and shrub growth that year (see Vegetation, Section 3.18.1). Based on revised population modeling, the total population in 2006 was 60,080 animals (Frost, 2007). The most recent revised population model also reevaluated populations in past years. Thus, the estimated post-season population in 2005 was revised to 58,131, in 2004 to 51,357, and in 2003 to 48,532 pronghorn. The current population model (Frost, 2007) projects an increasing population for the entire Sublette Herd Unit although observed fawn production declined in 2005 and 2006.

Table 3.22-1
Pronghorn Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate[1]	Preseason Fawns per Doe [1]	Harvest [2]			
			Bucks	Does	Fawns	Total
1999	44,191	0.763	2,909	2,113	374	5,396
2000	42,097	0.570	3,447	2,492	343	6,282
2001	43,348	0.619	2,245	1,053	373	3,671
2002	43,630	0.615	2,467	1,477	212	4,156
2003	44,239	0.597	2,435	1,585	161	4,181
2004	42,460	0.740	2,444	1,544	239	4,227
2005	47,930	0.688	2,248	1,583	143	3,974
2006	60,080	0.658	2,364	1,824	205	4,393

[1] Estimates of modeled population for the given year as reported in WGFD, 2000-2007, Annual Big Game Herd Unit Reports.
[2] WGFD, 2000-2007. Annual Reports of Big and Trophy Game Harvest.

From 1999-2003, harvest had been variable, but generally increased since 2001, especially the doe harvest, which had increased 1.5 times between 2001 and 2003. Doe harvest in 2006 was 1,824 animals, the highest since 2001 (Table 3.22-1). Doe harvest since 1999 has been much less than during the 1980s and early 1990s, when harvest exceeded 5,000 does in 1992 (BLM, 2004a).

WGFD began modeling the northern portion of the Sublette Herd Unit population in 1997; that portion includes animals inhabiting the PAPA. Data are provided for the northern Sublette Herd Unit in Table 3.22-2. Fawn production in the northern portion had been lower than in the entire herd unit from 1999 through 2005. In 2006, the observed fawn production of 0.691 fawns per doe exceeded that in the entire herd unit (0.658 fawns per doe). Although a likely consequence of decreased precipitation and concomitant decreased shrub production, the reason(s) for the observed variability of fawn production in the northern portion of the herd unit has not been documented.

Table 3.22-2
Pronghorn Northern Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Preseason Fawns per Doe [1]	Harvest [2]			
			Bucks	Does	Fawns	Total
1999	20,006	0.711	1,123	560	80	1,763
2000	18,927	0.525	1,279	685	119	2,083
2001	18,581	0.545	920	377	39	1,336
2002	23,249	0.578	1,056	498	38	1,592
2003	22,290	0.550	1,024	531	50	1,605
2004	21,964	0.680	1,095	543	70	1,708
2005	27,537	0.652	982	614	75	1,671
2006	28,869	0.691	1,092	935	114	2,141

[1] Estimates of modeled population for the given year as reported in Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Green River Region, 2000-2007.
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2007.

Annual adult doe survival rates, estimated from animals radio-collared in GTNP and BTNF, have been high, ranging from 97 percent survival in 1998-1999 to 84 percent survival in 1999-2000 (Sawyer and Lindzey, 2000). A study is currently underway to document pronghorn movements, habitat use, and responses to habitat alterations and disturbance, including natural gas developments in the PAPA (Berger et al., 2006). In the first progress report from the study, Berger et al. (2006) compared several variables between two experimental groups: pronghorn exposed to natural gas development (treatment group) in the PAPA and pronghorn not exposed to the development (control group). In 2006, no significant differences were detected among animals in the two study groups for the following: body mass, stress hormones (fecal corticosteroids), disease antibodies, and vitamins and minerals in blood sera (including polychlorinated biphenyls (PCBs) and organochlorides). While survival rates were lower in the treatment group (69.3 percent) than the control group (95 percent), the difference was not statistically significant (Berger et al., 2006).

Snow depths influenced the distribution of pronghorns; they rarely used areas where snow was 7.5 inches deep (± 1.5 inches) but were most likely to be where snow was 5.5 inches deep or less (Berger et al., 2007). During 2005, pronghorn kept a distance of 330 feet from well pads, although some individuals spent extensive time near pads (Berger et al., 2006). Preliminary study results in 2005 suggested that continual fragmentation of previously undisturbed land led to reduced use by pronghorn. Pronghorn appeared to abandon habitat in parcels with patch sizes at or about 600 acres (Berger et al., 2006). Similar observations during 2006 were not reported (Berger et al., 2007). During winter 2006, some radio-collared pronghorns utilized portions of the Jonah Field, apparently indicating some habituation to disturbances, while other study animals completely avoided wellfield disturbances. In the PAPA, pronghorns wintered extensively on crucial winter ranges previously defined by WGFD, though study animals did not avoid wellfield disturbances within the PAPA as some did within the Jonah Field (Berger et al., 2007).

The study has corroborated the importance and use of the Trapper's Point Bottleneck by pronghorns migrating to and from crucial winter ranges in the PAPA (Berger et al., 2007). In addition, the principal north and south migratory movements of animals within the PAPA appear to be west of the Anticline Crest and the wellfield development along the North Anticline Road. All, or nearly all, study animals cross the New Fork River on a parcel of State Trust land (Berger et al., 2007) approximately 1.7 to 2.9 miles southwest from the junction of the Paradise Road and North Anticline Road. Once across the New Fork River, all migratory pronghorns continue moving west of the Anticline Crest as they cross Highway 351 but some shift farther west, to the vicinity of the Burma Road, while others' movements are offset but parallel to the Jonah North Road as they move south toward the Jonah Field.

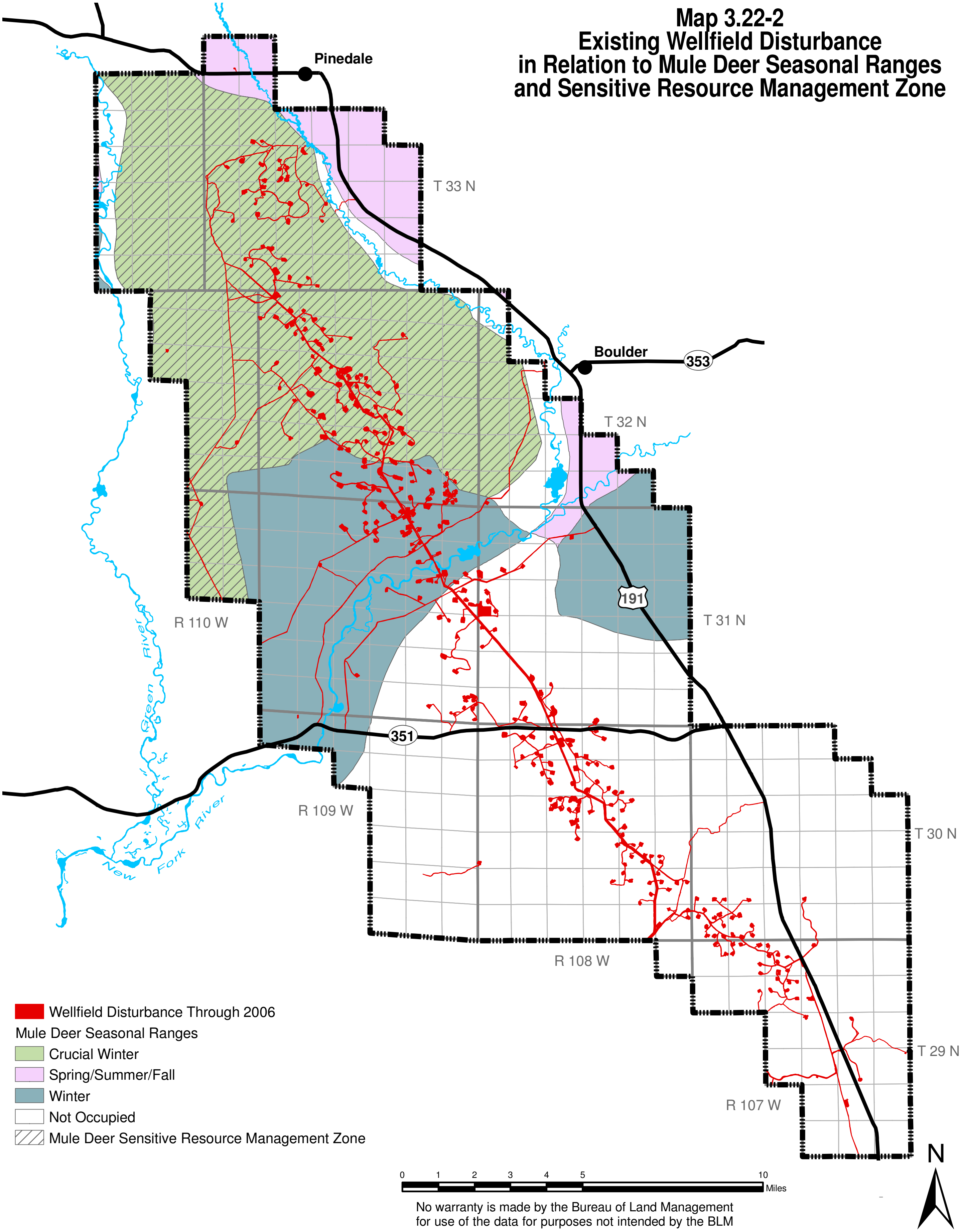
Most of the PAPA (150,324 acres) coincides with habitats used by pronghorn primarily during spring, summer, and fall (Table 3.22-3). Nearly 25 percent of the PAPA (47,590 acres) is pronghorn crucial winter range. The PAPA DEIS (BLM, 1999a) identified all crucial winter range as the Pronghorn SRMZ (Map 3.22-1). Surface disturbance associated with wellfield development has been proportionately more extensive within crucial winter range than in other seasonal ranges in the PAPA. As of November 2006, there were 4,834.6 acres of wellfield disturbance in the PAPA (all of which is in pronghorn seasonal ranges).

Table 3.22-3
Existing Wellfield Disturbance in
Relation to Pronghorn Seasonal Ranges

Pronghorn Seasonal Ranges	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Crucial Winter Range and Pronghorn SRMZ	47,590	1,327.7	249.6	1,577.3
Spring/Summer/Fall Range	150,324	2,813.3	444.0	3,257.3
Winter Range	120	0.0	0.0	0.0
Total	**198,034**	**4,141.0**	**693.6**	**4,834.6**

Mule Deer. Much of the PAPA coincides with crucial winter range utilized by mule deer in the Sublette Herd Unit (Map 3-22-2). Mule deer summer in mountainous terrain surrounding the PAPA to the west (Salt River Range and Wyoming Range), north (Snake River Range and Gros Ventre Range), and east (Wind River Range). They migrate to winter ranges in the PAPA and Pinedale Front Complex, traveling up to 60 to 100 miles although a few mule deer appear to be yearlong residents of the Pinedale Mesa (Sawyer and Lindzey, 2001).

Depending on snow conditions, mule deer may begin arriving on winter ranges on the Pinedale Mesa during late October (Sawyer and Lindzey, 2001), later during mild winters. If winter conditions are mild, deer may move northwest, to the vicinity of Cora Butte (Sawyer et al., 2003). Most migratory mule deer wintering on the Pinedale Mesa begin movements back to their summer range in late March or early April, depending on weather conditions (Sawyer and Lindzey, 2001).



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From 1995 to 2001, the population increased from approximately 27,000 to more than 37,000 then declined to 33,000 animals in 2002, further decreased to 27,000 in 2004 (Clause, 2005) though increased slightly in 2005 (Table 3.22-4). After winter 1992-1993, the population was at an all-time low and the WGFD eliminated or greatly reduced doe and fawn harvest (harvest of any deer) to accelerate population growth (Smith, 2003). Harvest of all sex and age groups was further reduced from 2003 through 2005 (Clause, 2006a). The estimate of fawns per doe adjusted for harvest (Table 3.22-4) is used to compare fawn production in years with few or no does harvested to production in years with more does harvested (Ayers et al., 2000). Fawn productivity since winter 1992-93 increased through 1997, but has been erratic since then. Fawn productivity declined from 2003 to 2005 but increased in 2006 (Table 3.22-4).

Table 3.22-4
Mule Deer Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Fawns per Doe Postseason [1]	Fawns per Doe Adjusted for Doe Harvest	Harvest [2]			
				Bucks	Does	Fawns	Total
1999	32,594	0.795	0.794	2,478	23	10	2,511
2000	36,564	0.819	0.810	2,991	226	22	3,239
2001	37,358	0.704	0.694	2,787	372	64	3,223
2002	32,949	0.644	0.618	2,742	817	71	3,630
2003	34,022	0.782	0.769	1,946	305	35	2,286
2004	26,633	0.684	0.672	1,689	302	38	2,029
2005	28,044	0.653	0.649	1,597	172	51	1,820
2006	26,474	0.770	0.752	1,546	353	33	1,932

[1] Estimates of modeled population for the given year as reported in Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2007.
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2007.

Depressed fawn production observed from 2000-2003 has been attributed to drought conditions (Smith, 2003). For all other big game species discussed in this section, production of young increased in 2004, possibly as a response to improved forage following increased precipitation beginning in winter 2003-2004 (see Table 3.3-1). Mule deer fawn production did not follow the trend but rather declined further in 2004 and continued to decline through 2005 (Table 3.22-4).

The annual precipitation by water year has been approximated for crucial winter ranges in the herd unit (Section 3.3 and Wildlife Technical Report, Appendix 17). Annual precipitation from 2000 through 2003 was well below the average precipitation of the previous 30 years. By the time herd composition surveys were conducted in 2001, there had been two consecutive years of below-average precipitation (including winter snowfall), three consecutive years in 2002, and four years of drought in 2003. The trend of low precipitation continued at least through water year 2003. Precipitation in 2004 and 2005 was above the 30-year average but was well below average during water year 2006. Snowfall in winter 2006-2007 was below average (see Table 3.3-1).

Over-winter mortality of fawn and adult mule deer in the Sublette Herd Unit has been estimated since 1993 (Wildlife Technical Report, Appendix 17). Throughout the period of data collection, adult over-winter mortality rates have been low, ranging from 26 percent mortality (74 percent survival) in winter 2002-2003 to 3 percent mortality (97 percent survival) in winter 1998-1999. Fawn over-winter mortality rates have been higher than adult deer mortality rates in any given year, and significantly higher than adult mortality since winter 2001-2002.

Adult doe mule deer survival in the Sublette Herd Unit has also been monitored by radio telemetry (Sawyer et al., 2003). In general, over-winter survival rates of telemetered adult does have deviated (though not significantly) from survival rates estimated by age ratios (Wildlife

Technical Report, Appendix 17). Female adult mule deer over-winter survival has been consistently above 80 percent survival since the study began in 1999 (Sawyer et al., 2003).

In the PAPA and other winter ranges in the Sublette Herd Unit, over-winter fawn mortality is directly related to total snowfall November through March. Additionally, drought or wet conditions on the winter range during the previous two years' growing seasons strongly influence fawn over-winter mortality by ameliorating or exacerbating the influence of winter snowfall (Wildlife Technical Report, Appendix 17). For example, a 65 percent fawn mortality rate during winter 2003-2004 was associated with approximately 50 inches of snowfall, totaled from November through March, and only 15 inches of total precipitation (total inches of water including the water equivalent of snowfall) during the previous two growing seasons. Approximately 41 inches of snow fell during winter 2004-2005 but there was 21 inches of total precipitation during the 2 years prior. Fawn mortality in winter 2004-2005 was only 31 percent. During winter 2005-2006, the mortality rate of fawns on winter ranges along the Pinedale Front Complex was significantly greater than mortality of fawns on winter ranges in the Mesa Complex, the only year since 1992 with such a significant difference. Although climatological data do not indicate that winter conditions were more severe on the Pinedale Front Complex than on the Mesa Complex, anecdotal observations made a case for increased winter severity. There are no NWS stations within or proximate to the Pinedale Front Complex to confirm the observations (Wildlife Technical Report, Appendix 17). Fawn mortality rates on the two winter range complexes were not significantly different during winter 2006-2007.

The Trappers Point Bottleneck, described above for pronghorn, limits migration of mule deer to and from the PAPA (Sawyer and Lindzey, 2001). The bottleneck may contribute to mule deer-vehicle mortality in the 7-mile length of U.S. Highway 191 between Pinedale and Daniel Junction. Available data indicate that many more deer than pronghorns have been killed by vehicles in the 7-mile length of highway (WGFD, 2004c and Carpenter, 2006). Generally, the proportion of mule deer fawns killed by vehicles is greater than the proportion of fawns in the Sublette Herd Unit, indicative of their susceptibility. Numbers of mule deer killed by vehicles along U.S. Highway 191 and State Highway 351, reported by WDOT from 1999 through 2005 (Carpenter, 2006), do not appear to be related to traffic volume on either highway. There were 121 mule deer killed by vehicles on U.S. Highway 191 in 2006 between milepost 110 (Daniel Junction) and milepost 58 (7 miles north of the Sweetwater County line). Within that same portion of U.S. Highway 191, 40 mule deer were killed in 2005 but 159 deer (includes two white-tailed deer) were killed in 2004 (Carpenter, 2007). Traffic volumes had increased from 2004 to 2006 (Section 3.6.1.1).

Wildlife population growth depends not only on birth and death rates, but also on immigration and emigration of animals into and out of the population. Results of the Sublette Mule Deer Study (Phase II) have shown a consistently declining wintering mule deer population on Mesa crucial winter ranges (Sawyer et al., 2005a). Deer density decreased from 77 deer per square mile in winter 2001-2002 to 41 per square mile in 2004-2005. The density in 2005-2006 was similar to that in the previous winter (Sawyer et al., 2006). No such trend was observed on crucial winter ranges used as a control in the study (Pinedale Front Complex) that were unaffected by natural gas development. Although the wintering mule deer population on the Pinedale Mesa has declined each year from 2001 to 2005, available information indicates deer are not using alternative habitats, since emigration to other winter ranges is extremely limited. Fewer deer each year may indicate increased mortality of deer that formerly utilized the Mesa, along with declining recruitment of additional deer on the winter range since 2001-2002.

Coincidental with the declining wintering population, use of habitats on the Mesa by wintering mule deer is lowest where well pads have been developed (Sawyer et al., 2004). Areas categorized as high mule deer use prior to development changed to low use as development progressed and areas of low use changed to higher use areas (Sawyer et al., 2005a). This suggests that the natural gas development on the Mesa has displaced mule deer to less suitable habitat within the Mesa Winter Range Complex. Mule deer have progressively used areas farther away from well pads and development, with the exception of winter 2003-2004, when deep snow may have reduced available habitat options. There were fewer deer on the Mesa in winter 2003-2004 than before 2001, even though winter habitat use patterns by deer were similar during the two periods. During winter 2004-2005, mule deer use of habitats on the Mesa was most similar to use patterns observed during the previous winter. In both years, mule deer shifted away from using some habitat areas that had been high use areas prior to development, but not to the same degree as during the second and third years of the study (2001-2002 and 2002-2003). Mule deer abundance in 2005 was similar to abundance the previous winter (Sawyer et al., 2006).

Twenty-five percent of the PAPA (54,242 acres) coincides with mule deer crucial winter range (Table 3.22-5). In the PAPA DEIS (BLM, 1999a), all mule deer crucial winter range defined by WGFD and winter/yearlong range defined by BLM were included in the Mule Deer SRMZ. Since the PAPA DEIS, WGFD reclassified seasonal ranges in the PAPA and the current distribution of crucial winter range is now the Mule Deer SRMZ shown in Map 3.22-2. There were more than 2,400 acres disturbed by wellfield activities within mule deer seasonal habitats by November 2006. Most of the surface disturbance is within crucial winter range.

Table 3.22-5
Existing Wellfield Disturbance in Relation to Mule Deer Seasonal Ranges

Mule Deer Seasonal Ranges	Total Area in the PAPA (acres)	Existing Wellfield Disturbance through 2006 (acres)		
		Federal Lands	Non-Federal Lands	All Lands
Crucial Winter Range and Mule Deer SRMZ	54,242	1,217.5	241.6	1,459.1
Spring/Summer/Fall Range	10,396	5.0	2.7	7.7
Winter Range	35,248	801.9	196.9	998.8
Winter/Yearlong Range	7,320	4.8	9.8	14.6
Total	**107,206**	**2,029.2**	**451.0**	**2,480.2**

Elk. The PAPA coincides with two elk herd units, the Green River Herd Unit and the Pinedale Elk Herd Unit. The Green River Herd Unit occupies the northernmost portion of the PAPA as non-crucial winter range (1,324 acres) and winter/yearlong range (997 acres). No seasonal ranges in the PAPA are occupied by elk in the Pinedale Herd Unit. No wellfield development has occurred in any seasonal habitats used by elk through 2006. An elk SRMZ was not identified in the PAPA. Each year, WDOT has recorded a few vehicle related mortalities of elk along U.S. Highway 191, primarily north of Daniel Junction and not in the vicinity of the PAPA (Carpenter, 2006).

Since 2000, calf production in the Green River Herd Unit declined through 2002. Calf production increased in 2004, similar to pronghorn and moose (below). Calf productivity in the Green River Herd Unit appears lower than in the Pinedale Herd Unit (BLM, 2004a). Harvest of all sex and age groups decreased since 2000, except for bulls, which increased in 2004 (Table 3.22-6).

Long-term trends for elk in the Green River Herd Unit indicate calf production has been significantly declining since the late 1970s. Data for the Pinedale Herd Unit do not reveal such a significant declining trend (BLM, 2000-2007, Annual Big Game Herd Unit Reports) and are not included in Table 3.22-6 because occupied portions of the herd unit do not coincide with the PAPA.

Table 3.22-6
Elk Green River Herd Unit Populations, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Calf per Cow Postseason [1]	Calf per Cow Adjusted for Harvest	Harvest [2]				
				Bull	Spike	Cow	Calf	Total
1999	3,855	0.248	0.248	138	24	212	54	428
2000	3,461	0.317	0.315	190	54	345	104	693
2001	3,122	0.302	0.284	157	37	280	45	519
2002	2,544	0.203	0.222	178	17	342	109	646
2003	2,049	0.227	0.225	179	27	260	55	521
2004	2,258	0.281	0.269	217	24	226	44	511
2005	2,506	0.239	0.251	144	31	203	72	450
2006	2,567	0.281	0.269	129	22	168	30	349

[1] Estimates of modeled population for the given year as reported in WGFD, 2000-2007, Annual Big Game Herd Unit Reports.
[2] WGFD, 2000-2007, Annual Reports of Big and Trophy Game Harvest.

Wintering elk in both herd units are sustained on feedgrounds that, in part, are maintained to avoid elk conflicts with livestock and private property, especially for elk in the Pinedale Herd Unit (Clause, 2007b). The Scab Creek, Muddy Creek, and Fall Creek feedgrounds in the Pinedale Herd Unit have been established since 1976, and combined, supported approximately 1,747 elk during winter 2005-2006 (Clause, 2006b). Three feedgrounds in the Green River Herd Unit (Black Butte, Green River Lakes, and Soda Lake) supported approximately 2,015 elk during winter 2005-2006 (Clause, 2006c). Elk on all six feedgrounds are vaccinated against brucellosis.

Moose. In the PAPA DEIS (BLM, 1999a), the Moose SRMZ coincided with crucial winter/yearlong moose habitat for the Sublette Herd Unit, found primarily within the riparian zone associated with the New Fork River (Map 3.22-3). Slightly more than 18,000 acres of moose crucial winter/yearlong have been defined within the PAPA. As of November 2006, 146.9 acres were disturbed within this habitat by wellfield activities.

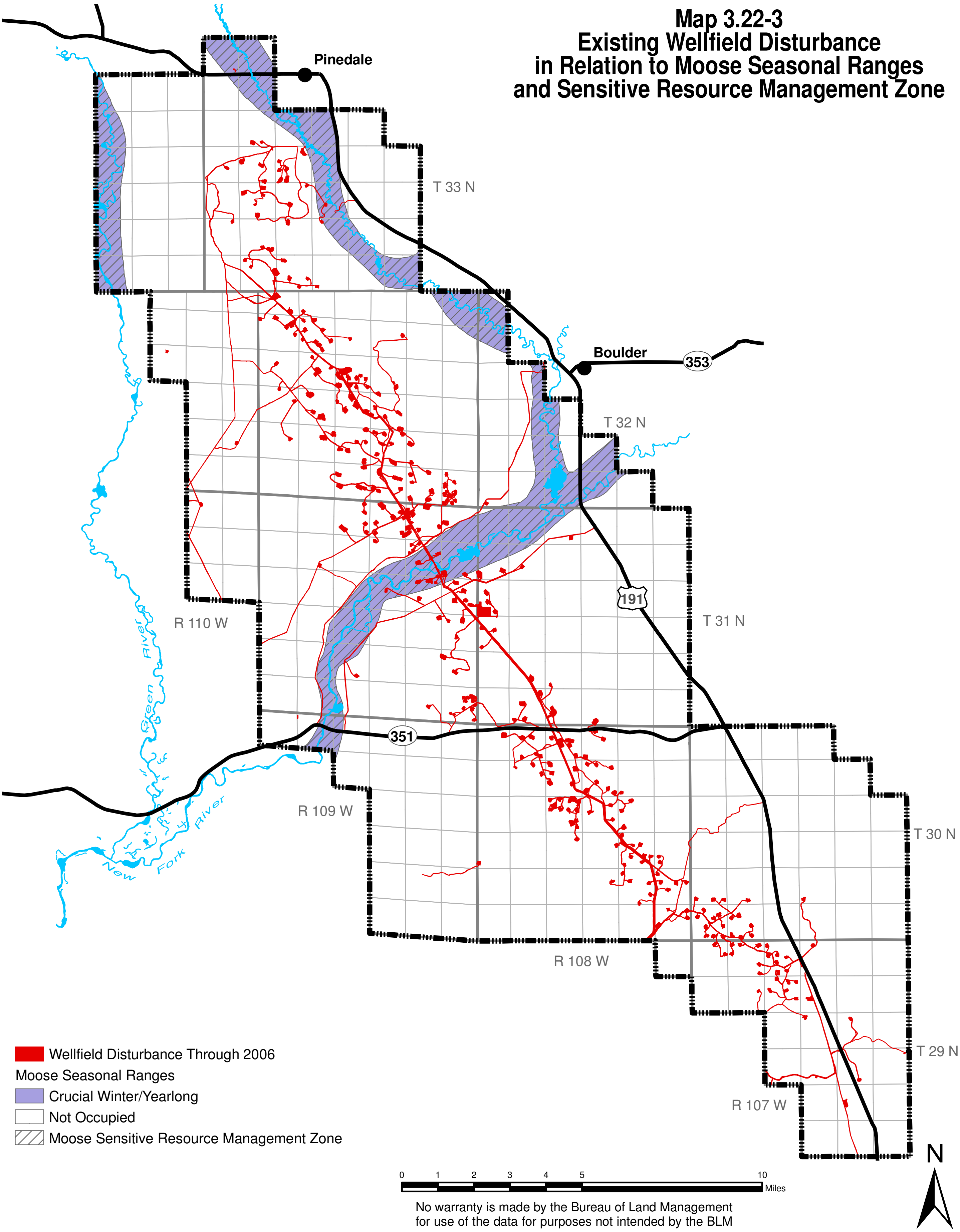
The Sublette Herd Unit moose population has declined recently, and the production of calves per cow (adjusted for harvest) has significantly declined from 1994 through 2005 (Table 3.22-7). Similar to pronghorn and elk populations near the PAPA, moose calf production in the herd unit increased in 2004 and 2005 although harvest of bulls, cows, and calves were reduced in both years from harvest levels in 2003. Moose have been killed by vehicles on U.S. Highway 191, near the PAPA, but only occasionally since 1999 (Carpenter, 2006). In 2006, two yearling moose were killed on U.S. Highway 191 between milepost 92 and milepost 98, south of Pinedale (Carpenter, 2007).

Table 3.22-7
Moose Sublette Herd Unit Populations, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Calf per Cow Postseason [1]	Calf per Cow Adjusted for Harvest	Harvest [2]			
				Bull	Cow	Calf	Total
1999	5,817	0.427	0.405	306	171	21	498
2000	5,967	0.458	0.435	332	172	28	532
2001	5,665	0.344	0.337	352	160	39	551
2002	3,726	0.417	0.406	362	144	35	541
2003	4,028	0.350	0.334	339	161	18	518
2004	4,107	0.412	0.401	258	84	10	352
2005	3,926	0.409	0.400	227	57	5	289
2006	4,066	0.448	0.441	219	53	7	279

[1] Estimates of modeled population for the given year as reported in WGFD, 2000-2007, Annual Big Game Herd Unit Reports.
[2] WGFD, 2000-2007, Annual Reports of Big and Trophy Game Harvest.

Map 3.22-3
Existing Wellfield Disturbance in Relation to Moose Seasonal Ranges and Sensitive Resource Management Zone



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3.22.1.2 Upland Game Birds

Greater sage-grouse is the predominant upland game bird in southwest Wyoming. Greater sage-grouse have been casually observed on BBS routes conducted throughout the Upper Green River Basin region by cooperators with the USGS Patuxent Wildlife Research Center (Sauer et al., 2007). Observations of number of greater sage-grouse counted per BBS route indicate that their relative abundance since 1994 peaked in 2000 but has been declining (Figure 3.22-1).

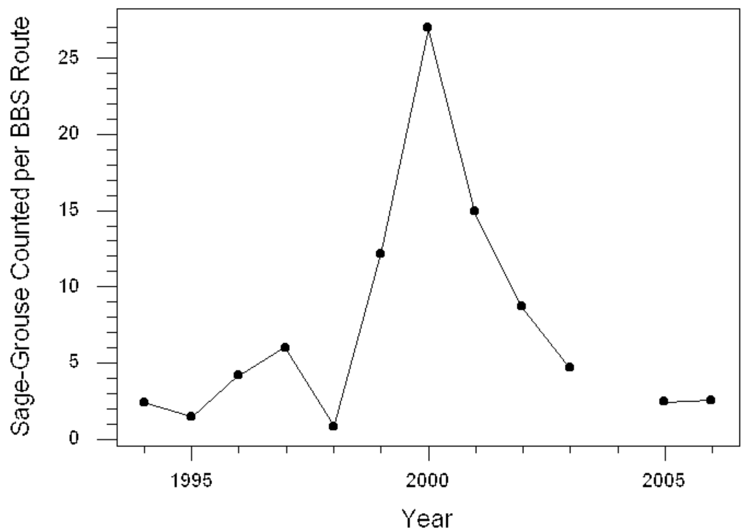
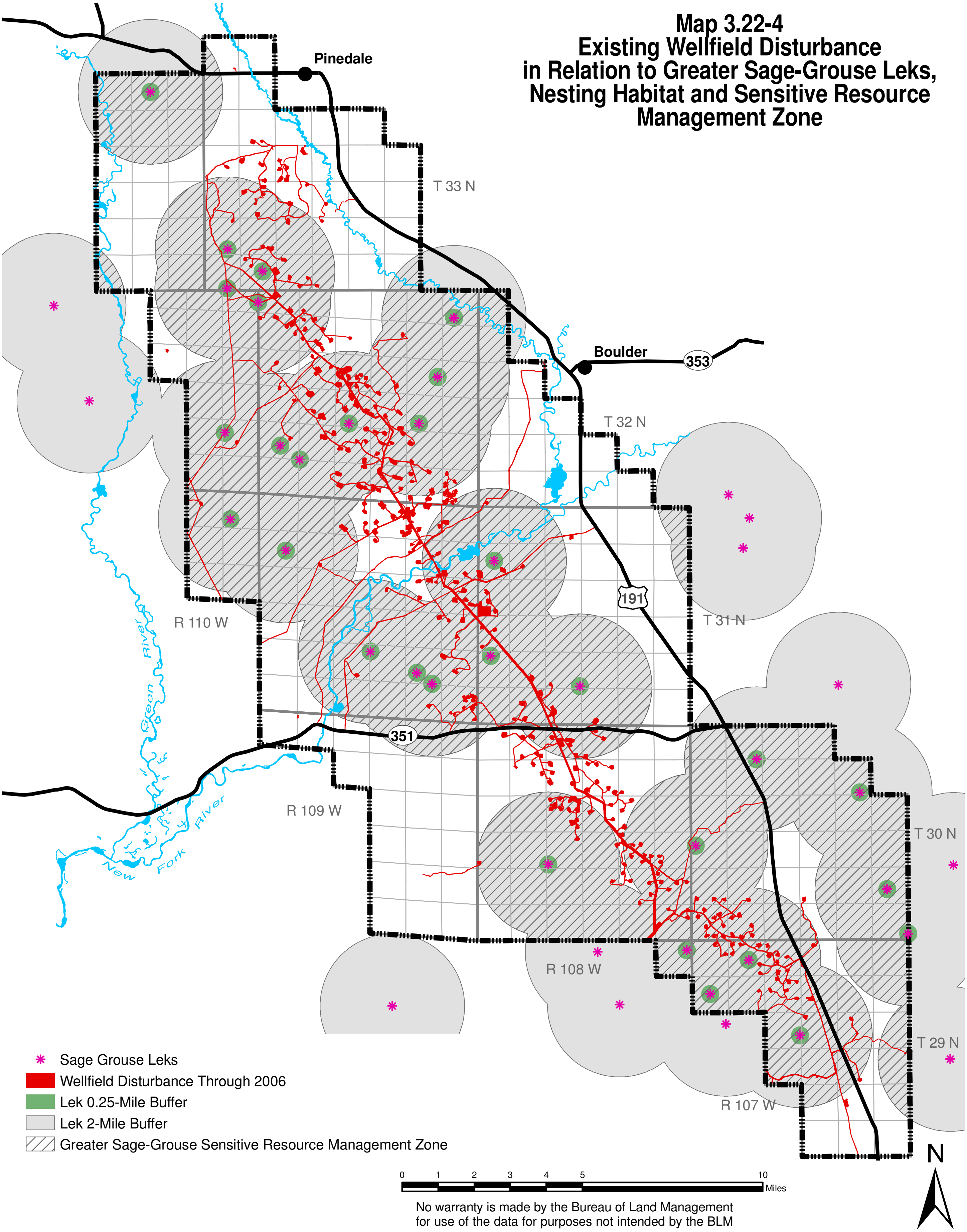


Figure 3.22-1
Greater Sage-Grouse Counted per Breeding Bird Survey Route within the Upper Green River Basin, 1994 through 2006
(Source: Sauer et al., 2007)

Adult male greater sage-grouse arrive first on leks, usually by mid-March, thereafter joined by sub-adult males and females (Lyon, 2000). Females move to nest site vicinities several days after copulation (Lyon, 2000). Although reports indicate that most females nest within 2 miles of leks where they breed (Braun et al., 1977), some greater sage-grouse hens in the PAPA have nested farther than that. The greatest distance from lek to nest was over 28 miles, observed for one female (Lyon, 2000). Greater sage-grouse hens tend to nest in the same vicinity in consecutive years (Lyon, 2000). In the PAPA DEIS (BLM, 1999a), greater sage-grouse nesting habitat was assumed to include areas within a 2-mile radius around each active and inactive lek, even though distances from leks to nests in the region can be quite variable (Heath et al., 1997 and Lyon, 2000). The current distribution of leks in the PAPA, including those within 2 miles of the PAPA boundary, is shown in Map 3.22-4.

The PAPA is within Small and Upland Game Management Area (SUGMA) 3 (Bridger) north of the New Fork River, and in SUGMA 7 (Eden) south of the river. The WGFD documented harvest data, including total hunters, total recreation-days, and total greater sage-grouse harvested in both SUGMAs since 1982. With data from both areas combined, there have been significant declining trends in numbers of hunters, total hunting recreation-days, and total greater sage-grouse harvested during the past two decades. Of particular importance is the


Map 3.22-4
Existing Wellfield Disturbance
in Relation to Greater Sage-Grouse Leks,
Nesting Habitat and Sensitive Resource
Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Sage Grouse Leks
Wellfield Disturbance Through 2006
Lek 0.25-Mile Buffer
Lek 2-Mile Buffer
Greater Sage-Grouse Sensitive Resource Management Zone
0
1
2
3
4
5
10
Miles
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total number of greater sage-grouse harvested per recreation-day, which has significantly declined since 1982, suggesting declining greater sage-grouse abundance (Figure 3.22-2).

The decline has occurred even though WGFD has shortened harvest seasons, delayed opening season dates to increase survival of reproductive hens, and decreased bag limits to enhance population growth (Clause, 2006d). Harvest per recreation-day did increase from 2002 through 2005, possibly reflecting increased survival following above-average precipitation in 2004 and 2005 (see Table 3.3-1) as well as the effects of more conservative harvest management. However, harvest per recreation day declined in 2006 (Figure 3.22-2).

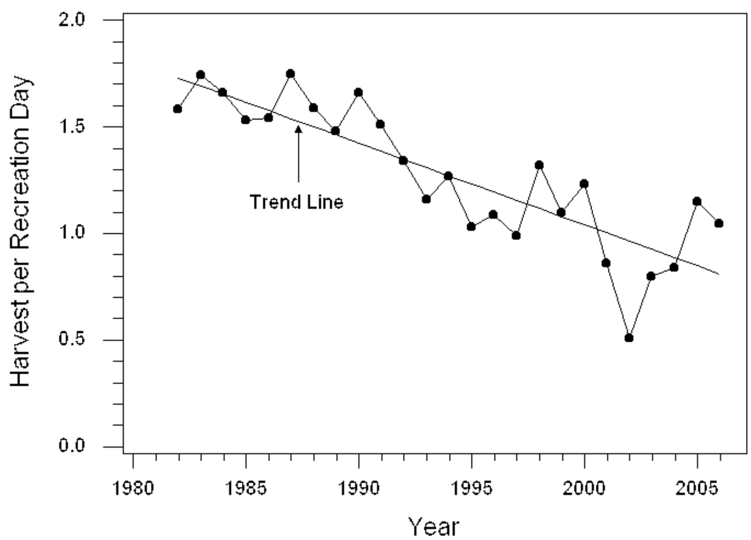


Figure 3.22-2
Greater Sage-Grouse Harvested per
Recreation-Day in SUGMA 3 and 7 Combined, 1982 to 2006
(Source: WGFD, 1983-2007, Annual Reports of Upland Game and Furbearer Harvest)

Annual census of greater sage-grouse leks has been used to track changes in the breeding population (Connelly et al., 2004), particularly if leks are censused repeatedly within a given year so that the peak in male attendance can be determined (Jenni and Hartzler, 1978). Data on peak male attendance at leks within SUGMAs 3 and 7 have been compiled by WGFD (Christiansen, 2007). To evaluate potential effects of oil and gas development on greater sage-grouse lek attendance, records compiled by the WOGCC for all oil and gas wells within the state were obtained (Meyer, 2007) including those that are within SUGMAs 3 and 7. Along with other information, each record provides the most recent status and location for a well. The summaries in Table 3.22-8 are based on locations of each lek and each producing oil or gas well within SUGMAs 3 and 7, the linear trend (increasing, no trend, or decreasing trend derived from linear regression analysis) in peak male attendance at each lek during the past 10 years (1998-2007), and each lek's current status (in 2006 or 2007, whenever last surveyed). Only leks that had been censused in at least 5 of the past 10 years were included in the analysis.

Eight leks in the two SUGMAs combined, were active in 2007 but each demonstrated significant decreasing trends in peak numbers of attending male since 1998. Similarly, there were 17 leks that were inactive in 2007 and all had significant declining trends for the past 10 years. Taken

Table 3.22-8
Patterns in Peak Lek Attendance by Male Sage-Grouse in Small and Upland Game Management Areas 3 and 7 from 1998 through 2007

Current (2006 or 2007) Lek Status [1]	10-Year Trend Peak Male Attendance (1998-2007)	Number of Leks With Current Status and Trend	Mean Yearly Peak Male Attendance in 10 years (95% Confidence Interval)	Mean Number of Producing Wells[2] Within 2-mile Radius (95% Confidence Interval)
Active	Increasing	28	73.13 (± 18.26)	2.68 (± 3.59)
	No Trend	54	40.50 (± 7.61)	7.37 (± 6.15)
	Decreasing	8	24.73 (± 16.45)	25.50 (± 10.64)
Inactive	No Trend	16	5.87 (± 6.48)	17.69 (± 22.35)
	Decreasing	17	9.11 (± 4.71)	32.68 (± 16.98)
Unknown	No Trend	3	36.87 (± 30.44)	0

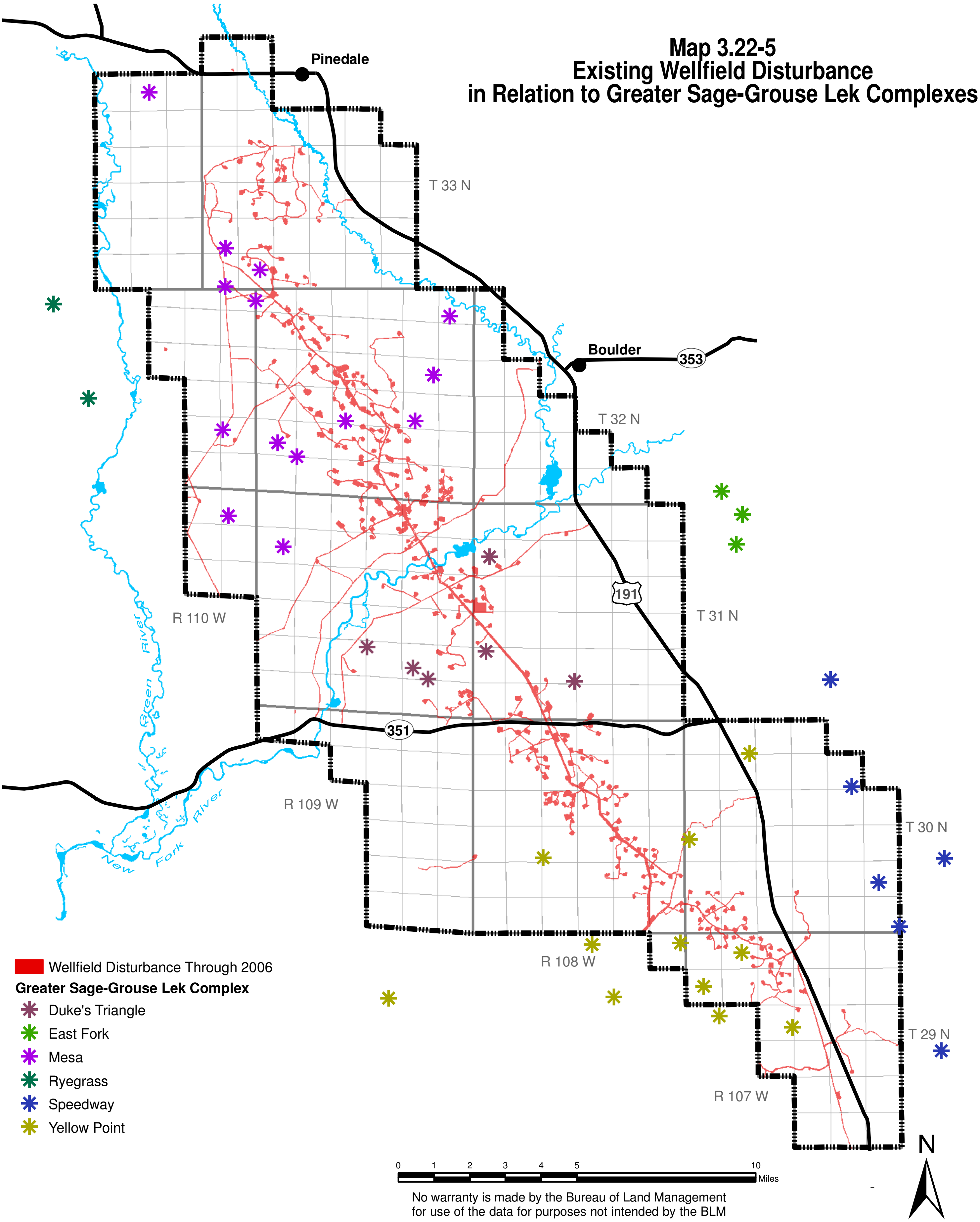
[1] Only includes leks that had been surveyed at least 5 out of the past 10 years and does not include abandoned leks. Source: Christiansen, 2007.
[2] Includes producing oil and gas wells, flowing wells, active injector wells, and other types requiring worker visits. Source: Meyer, 2007.

as a group, leks with decreasing peak male attendance had significantly more producing oil or gas wells within a 2-mile radius from the lek location than the 28 leks that demonstrated significant increasing trends in peak numbers of attending males since 1998 (Table 3.22-8).

Available information does not indicate that any of the producing oil or gas wells within 2 miles of any lek were drilled during periods of lek attendance. However, once drilled, completed, and productive, wells require regular visits by wellfield workers for maintenance and product transport. Vehicular traffic associated with producing wells must continue throughout the year (Section 3.6.1.1 – Transportation), regardless of the status of greater-sage grouse leks. Thus, the number of producing oil and gas wells within a 2-mile radius of greater sage-grouse leks represents a relative amount of wellfield disturbance due to a variety of activities, mostly vehicular traffic, during all seasons including greater sage-grouse breeding, nesting, and juvenile rearing periods in the species' annual cycle.

The PAPA coincides with three greater sage-grouse lek complexes, the Mesa Complex north of the New Fork River, Duke's Triangle Complex south of the river and north of State Highway 351, and the Yellow Point Complex with leks in the southern portion of the PAPA (Map 3.22-5). The Upper Green River Basin Sage-Grouse Working Group (2006) defines a lek complex as a group of leks near each other where regular interchange of male greater sage-grouse is expected. In 2001, there were eight active leks in the Mesa Complex, three active leks in the Duke's Triangle Complex, and six active leks in the Yellow Point Complex (Christiansen, 2007) for a total of 17 active leks. In all three complexes combined, there were five inactive leks and eleven additional leks with unknown status because they were not surveyed or were not located that year. By 2006, there were six active leks in the Mesa Complex (including one new lek - Lovatt West - formed in 2005), three active leks in the Duke's Triangle Complex (including one new lek - Duke's Triangle New – formed in 2005), and six active leks in the Yellow Point Complex (Christiansen, 2007) for a total of 15 active leks, two less than the total in 2001.

Only two leks, in all three complexes in the PAPA combined, have been increasing in peak male attendance from 1998 through 2007 while peak attendance has been decreasing at eleven leks, five of which are in the Yellow Point Complex (Table 3.22-9). In contrast, eleven leks


Map 3.22-5
Existing Wellfield Disturbance
in Relation to Greater Sage-Grouse Lek Complexes
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2006
Greater Sage-Grouse Lek Complex
Duke's Triangle
East Fork
Mesa
Ryegrass
Speedway
Yellow Point
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

within three other complexes proximate to the PAPA (Ryegrass Complex to the northwest, Muddy Creek Complex to the west, and Speedway Complex to the east) increased from 1998 through 2007 though none decreased in that period. Similar to the pattern found for all leks in SUGMAs 3 and 7, there were either none or very few producing oil and gas wells within 2 miles of all leks with increasing trends of peak male attendance from 1998 through 2007 (Table 3.22-9). All leks in the PAPA with decreasing trends had at least 18 producing wells within a 2-mile radius. There were no leks in complexes off the PAPA that had decreasing trends (Table 3.22-9). The data imply that the relative amounts of wellfield disturbance due to traffic and other actions related to wellfield production during all seasons within 2 miles of greater sage-grouse leks is related to declining male attendance at leks.

Table 3.22-9
Patterns in Peak Lek Attendance by Male Greater Sage-Grouse in and off the PAPA [1]

10-Year Trend in Peak Male Attendance (1998-2007)	Number of Leks With Trend	Mean Yearly Peak Male Attendance (range in value)	Mean Number of Producing Wells Within 2-mile Radius (range in value)
Lek Complexes in PAPA			
Mesa Complex			
Increasing	1	58	0
No Trend	8	37.5 (0 – 126)	7.1 (0 – 30)
Decreasing	3	13.7 (9 – 19)	107.3 (56 – 179)
Duke's Triangle Complex			
Increasing	0	N/A	N/A
No Trend	1	0	38
Decreasing	3	23.7 (2 – 42)	28.0 (18 – 41)
Yellow Point Complex			
Increasing [2]	1	9	0
No Trend	5	28.2 (2 – 53)	27.4 (9 – 54)
Decreasing	5	12.8 (1 – 42)	66.2 (22 – 189)
Lek Complexes off PAPA			
Ryegrass Complex			
Increasing	2	20.1 (2 – 38)	0
No Trend	8	15.0 (2 -31)	0
Decreasing	0	N/A	N/A
Muddy Creek Complex			
Increasing	3	39.2 (5 – 58)	0
No Trend	3	25.8 (2 – 54)	0
Decreasing	0	N/A	N/A
Speedway Complex			
Increasing	4	113.1 (79 – 156)	0.3 (0 – 1)
No Trend	2	50.7 (4 – 97)	0.5 (0 – 1)
Decreasing	0	N/A	N/A

[1] Sources: Christiansen, 2007 and Meyer, 2007.
[2] Male greater sage-grouse in the Prairie Dog lek changed the lek location in 2007 with higher peak attendance than at the former location.

Leks in and near the PAPA were intensively monitored between 1999 and 2004. The investigation indicated that male counts on leks that were heavily impacted by natural gas wells declined 51 percent from one year prior to well development through 2004 (Holloran, 2005). For example, on two leks in the PAPA, before development in 2001, average counts on each lek exceeded 15 males but only one male was observed only once on each lek in 2005, and none were seen at either lek in 2006 or in 2007. Generally, there were fewer strutting males on leks closer to drilling rigs than on leks farther away from drilling rigs.

Strutting male numbers decreased with increased traffic volumes within 1.86 miles of the leks and with increased noise intensity estimated at leks. The decline has been attributed to displacement of males from and low recruitment of yearling males on impacted leks (Holloran, 2005 and Kaiser, 2006).

Two new leks, one on the Mesa (Lovatt West) and south of the New Fork River (New Dukes Triangle), were found in 2005, both were active in 2006 but only the Lovatt West lek was active in 2007. During 2006 and 2007, there were no males observed at two leks on the Mesa (Mesa Springs and Lovatt Draw Reservoir) and as noted earlier, both leks are currently inactive.

Mature females are likely to reuse the same nest site; however, yearling females select nesting locations farther from haul roads and active drilling rigs, suggesting the long-term response of nesting females is avoidance of development areas (Holloran, 2005).

Greater sage-grouse also winter in the PAPA. Greater sage-grouse movements to winter ranges can take some time and may occur between late August and December. For example, most radio-telemetered greater sage-grouse were in the PAPA and vicinity by November 1998 but arrived later in the PAPA in 1999, possibly due to mild weather that year (Lyon, 2000). Wintering greater sage-grouse depend, in part, on sagebrush extending above the snow and Lyon (2000) documented numerous wintering greater sage-grouse on the Mesa and some within the PAPA south of the New Fork River. Likewise, distributions of greater sage-grouse winter fecal pellet groups surveyed by Wyoming Wildlife Consultants (BLM, 2004c) from 2001 through 2003 indicate wintering grouse are present in the PAPA, north and south of the New Fork River.

The PAPA ROD (BLM, 2000b) established seasonal restrictions in the form of guidelines for the protection of greater sage-grouse in seasonal habitats. The restrictions are stated in Appendix A of the PAPA ROD and are reiterated in Section 2.4.2 in Chapter 2. Subsequent to the PAPA ROD, BLM issued guidance for the protection of greater sage-grouse habitat in IM WY2004-057 (BLM, 2004b). This guidance is also provided in Section 2.4.2 in Chapter 2.

There are 113,325 acres included in the Sage Grouse SRMZ (Table 3.22-10) which are associated with the 2-mile buffers of all occupied leks. As of November 2006, there was approximately 20 acres of disturbance within the 0.25-mile buffer for greater sage-grouse leks. There was over 3,600 acres of disturbance within the 2-mile buffer and Sage Grouse SRMZ. Most disturbance is been on federal lands and minerals (Table 3.22-10).

Mourning doves are upland game birds potentially harvested in the PAPA, though not to the extent of greater sage-grouse. Ruffed grouse and chuckar may also be hunted in or near the PAPA (Table 3.22-11).

Table 3.22-10
Existing Wellfield Disturbance in Relation to Greater Sage-Grouse Lek Buffers and SRMZ

Lek Buffer	Total Area in the PAPA (acres)	Existing Wellfield Disturbance Through 2006 (acres)		
		Federal lands	Non-federal lands	All lands
0.25-Mile Buffer	2,831	20.36	0.0	20.36
2-Mile Buffer and Sage Grouse SRMZ	113,325	3,139.3	487.5	3,626.8

Table 3.22-11
Harvest Data For Other Upland Game Birds
and Derived Statistics in SUGMA 3 and 7 During 2006[1]

Game Bird	SUGMA	Hunters	Hunter Days	Harvest	Days per Hunter	Days per Harvest	Harvest per Day
Mourning Dove *Zenaida macroura*	3 - Bridger	25	79	112	3.16	0.71	1.42
	7 - Eden	74	143	361	1.93	0.40	2.52
Ruffed Grouse *Bonasa umbellus*	3 - Bridger	400	1,842	1,195	4.61	1.54	0.65
	7 - Eden	39	464	102	11.90	4.55	0.22
Chuckar *Alectoris chuckar*	7 - Eden	25	57	31	2.28	1.84	0.54

[1] Source: WGFD, 2007a.

3.22.1.3 Small Game and Furbearing Mammals

Harvest of cottontails and squirrels has been reported in SUGMAs 3 and 7, and both are potentially harvested in the PAPA. Ten species of furbearing mammals may be trapped, snared, or shot near the PAPA although harvest data are not compiled for furbearer species by SUGMA. Furbearers include badger, bobcat, weasel, coyote, raccoon, red fox, skunk, beaver, mink, and muskrat.

Populations of rabbits in North America may be cyclic (Dunn et al., 1982 and Chapman et al., 1982). Cottontails harvested per recreation-day in SUGMAs 3 and 7 since 1982 show a 6 to 7-year cycle of peaks. Apparent peaks in 1996 and 2003 were lower than earlier peaks in 1983 and 1990 (Figure 3.22-3), suggestive of an overall population decline at least during peaks. Harvest data from 1982 through 2005 may indicate that cycle intensity may be dampened given that the trend since 1982 has been fewer hunters spending fewer recreational days pursuing cottontails.

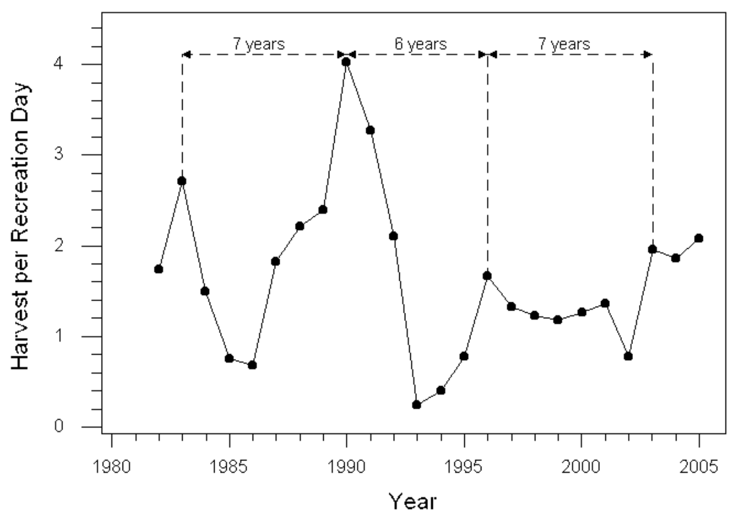


Figure 3.22-3
Cottontail Rabbits Harvested per Recreation-Day
in SUGMA 3 and 7 Combined, 1982 to 2006

3.22.1.4 Migratory Birds

Data compiled for nine National Biological Survey BBS routes in the upper Green River area reveal 150 bird species have been observed on one or more routes since 1980 (Sauer et al., 2007). Of those, 107 species are listed as Nearctic-Neotropical migratory birds by the USFWS, Division of Bird Habitat Conservation, pursuant to the Neotropical Migratory Bird Conservation Act.

Not all species on BBS routes are migrants, though, and data for many of the migratory species are sparse, limited to only a few observations some years on a few routes. BBS data for 45 migratory species in the region allowed estimation of trends from 1994 through 2006. With nine routes in the region, there were only 45 migratory species with barely adequate data to estimate trends over the past 13 years (1994-2006), with 2004 excluded. In 2004, only two of the nine routes were surveyed, an inadequate sample to include in further analysis. There were 16 of the 45 species with either increasing or decreasing linear trends during the 13-year period (Table 3.22-12).

Table 3.22-12
Neotropical Migratory Birds in the Vicinity of the PAPA with Decreasing or Increasing Trends Estimated from National Biological Survey Breeding Bird Survey Data from 1994 to 2006

Common Name Scientific Name	Nest Substrate[1]	General Habitat[1]	Trend (level of significance)
Great Blue Heron *Ardea herodias*	Trees	Riparian, lakes, rivers	Decreasing (P<0.10)
Northern Harrier *Circus cyaneus*	Ground in dense vegetation	Grassland, shrubland, marshes	Increasing (P<0.20)
Swainson's Hawk *Buteo swainsoni*	Trees, cliffs	Open areas below 9000 feet	Decreasing P<0.20)
Killdeer *Charadrius vociferus*	Ground	Shoreline, aquatic sites in most habitats	Decreasing (P<0.01)
Spotted Sandpiper *Actitis macularia*	Ground near water	Shorelines of rivers and lakes	Decreasing (P<0.10)
Northern Flicker *Colaptes auratus*	Cavity	Most habitats with trees/poles present	Decreasing (P<0.10)
Black-billed Magpie *Pica pica*	Small trees and shrubs	All habitats below 8000 feet	Increasing (P<0.20)
Horned Lark *Eremophila alpestris*	Ground	Shrublands and grasslands	Increasing (P<0.05)
Rock Wren *Salpinctes obsoletus*	Holes and crevices	Rock outcrops and rock piles	Increasing (P<0.20)
Mountain Bluebird *Sialia currucoides*	Cavity	Most habitats with nesting cavities and open areas	Decreasing (P<0.10)
Green-tailed Towhee *Pipilo chlorurus*	Shrubs and ground	Mixed conifer forest, woodland-chaparral, juniper-sagebrush, basin prairie and mountain foothills shrubland, riparian shrub	Increasing (P<0.20)
Vesper Sparrow *Pooecetes gramineus*	Ground	Shrubland, grassland, agricultural areas	Increasing (P<0.10)
Sage Sparrow *Amphispiza belli*	In or under sagebrush	Shrubland	Decreasing (P<0.05)
Savannah Sparrow *Passerculus sandwichensis*	Ground	Willows, grasslands, marshes, irrigated meadows	Increasing (P<0.05)
Song Sparrow *Melospiza melodia*	Ground	Riparian, marshes	Increasing (P<0.20)
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	Over water in emergent vegetation	Marshes	Decreasing (P<0.05)

[1] Abbreviated from descriptions by Cerovski et al., 2004.

Trends of abundances for eight migratory species appear to be declining; of these, three species (killdeer, spotted sandpiper, and sage sparrow) nest on or close to the ground in a variety of habitats. Two species with declining abundance nest in tree cavities (northern flicker and mountain bluebird) and four inhabit wetland and/or riparian habitats (great blue heron, killdeer, spotted sandpiper, and yellow-headed blackbird). The abundance of other species that utilize riparian or other moist habitats appears to be increasing (savannah sparrow and song sparrow) and both species nest on the ground. In addition to these two species, other species that appear to be increasing include northern harrier, black-billed magpie, horned lark, rock wren, green-tailed towhee, and vesper. Increasing numbers of black-billed magpies in the region could be indicative of increasing carrion due to increased traffic on area highways. Magpies in the region may be year-long residents (Dorn and Dorn, 1990).

Many common raptor species are known to nest, migrate, and seasonally reside, in the vicinity of the PAPA. These include golden eagle, red-tailed hawk, ferruginous hawk, great horned owl, bald eagle, Swainson's hawk, northern harrier, prairie falcon, American kestrel, merlin, osprey, and short-eared owl. These raptors and all other migratory birds are protected under the Migratory Bird Treaty Act in which taking, killing, or possessing migratory birds is unlawful. Although the common raven occurs in the PAPA, is a potential predator and/or scavenger, and classified as a raptor by some, it is in the same family as jays, magpies, and crows (Corvidae) and not discussed further. Nesting records of golden eagles, ferruginous hawks, short-eared owls, and other raptors, including American kestrel, osprey, great horned owl, northern harrier, prairie falcon, red-tailed hawk, and Swainson's hawk, have been made on or in the immediate vicinity of the PAPA since 2001, and their status in relation to wellfield development has been investigated (Ecosystem Research Group, 2006).

Sharp-shinned hawk, Cooper's hawk, northern goshawk, burrowing owl, and long-eared owl, may also be present in the PAPA during the summer. Birds that may winter in the PAPA include golden eagle, red-tailed hawk, rough-legged hawk, and great horned owl, as well as other less common species (Call, 1978).

3.22.1.5 Nongame Wildlife Species

Nongame mammals, birds, and herpetofauna that were likely to have inhabited the PAPA when the PAPA DEIS was issued (BLM, 1999a) are not likely to have changed since then. Numbers of select terrestrial nongame wildlife species potentially associated with the several vegetation-based habitats in the PAPA are provided in Table 3.22-13.

Table 3.22-13
Numbers of Terrestrial Nongame Wildlife Species
Expected in the Different Vegetation Categories in the PAPA[1]

Vegetation Category	Reptile Species Numbers		Bird Species Numbers		Mammal Species Numbers	
	Unique to Type	In Multiple Types	Unique to Type	In Multiple Types	Unique to Type	In Multiple Types
Sagebrush steppe	0	3	0	45	0	30
Mixed grass prairie	0	3	1	48	0	32
Greasewood flats	0	1	0	33	0	16
Desert shrub	0	1	0	48	0	24
Riparian forest and shrub	0	2	47	56	5	23
Other limited types	0	2	14	37	4	24
Barren ground	0	1	0	22	0	9
Irrigated cropland	0	1	8	47	0	14
Human settlement	0	2	6	45	0	10

[1] Based on distributions and habitat associations provided in Cerovski et al., 2004.

Most nongame reptiles, birds, and mammals likely to occur in the PAPA are expected within sagebrush steppe, the most extensive vegetation cover type in the area. However, the nongame species are also expected to utilize other available vegetation. There are some species of birds and mammals that are only likely to inhabit specific vegetation-based habits, particularly riparian forest and shrub. Amphibians potentially occurring in the PAPA have been identified above, in Table 3.21-2 and include tiger salamanders (Baxter and Stone, 1980).

3.22.1.6 Aquatic Resources

Aquatic resources in the PAPA were described in Section 3.20 of the PAPA DEIS (BLM, 1999a). The Green River and New Fork River provide habitats for several game fish species. Since 2000, WGFD surveyed in the Green River downstream and upstream from the confluence of the New Fork River and within the New Fork River, downstream of the confluence with the East Fork River and upstream to Pine Creek. The results of the investigations have been summarized in Annual Fisheries Progress Reports (WGFD, 2002, 2003a, 2004d, 2005, 2006b, and 2007b).

Sampling to estimate populations of game fish in the various river segments has been conducted in some years (Table 3.22-14). Though sample sizes for some species have been too small to allow population estimates, the values in Table 3.22-14 probably represent relative population sizes. Brown trout consistently appear to be most abundant in each of the river segments near the PAPA. Rainbow trout have generally been the next most abundant game fish, although abundance of Snake River cutthroat trout in the Green River, downstream of the confluence with the New Fork River, appeared to exceed rainbow trout in 2002.

Table 3.22.14
Population Estimates of Game Fish Species in
River Segments of the Green River and New Fork River Proximate to the PAPA[1]

River Segment	Common Name Scientific Name	Estimate of Fish > 6 inches per mile in River Segment[2]				
		2001	2002	2003	2004	2006
Green River Downstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	18	24	ns	ns	ns
	Brown Trout *Salmo trutta*	197	616	ns	ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	22	11	ns	ns	ns
Green River Upstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	ns	ss (1)	-	ns
	Brown Trout *Salmo trutta*	ns	ns	ss (150)	349	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	ns	ss (8)	164	ns
	Mountain Whitefish *Prosopium williamsoni*	ns	ns	928	-	ns
	Brook Trout *Salvelinus fontinalis*	ns	ns	-	12	ns
New Fork River Downstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ss (2)	ns	ns	ns	~1
	Brown Trout *Salmo trutta*	302	ns	ns	ns	305
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	5	ns	ns	ns	~9
	Kokanee Salmon *Oncorhunchus nerka*	ss (≥3)	ns	ns	ns	~7
	Lake Trout *Salvelinus namaycush*	ss (1)	ns	ns	ns	0

River Segment	Common Name Scientific Name	Estimate of Fish > 6 inches per mile in River Segment[2]				
		2001	2002	2003	2004	2006
New Fork River Upstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	2	~3	ns	ns
	Brown Trout *Salmo trutta*	ns	507	973	ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	16	~71	ns	ns
	Kokanee Salmon *Oncorhunchus nerka*	ns	-	~6	ns	ns

[1] Source: WGFD, 2002, 2003a, 2004d, 2005, 2006b, and 2007b.
[2] ss = sample too small for population estimate, followed by numbers of individuals observed, in parenthesis, ns = not sampled.

Rainbow trout have been declining in the Green River since stocking was discontinued prior to 2000. The abundance of mountain whitefish in the Green River, upstream of the confluence with the New Fork River, was greater than for all trout species in 2003 (Table 3.22-14). Other, less abundant, game species include kokanee salmon, brook trout, and lake trout.

In 2001, the abundance of rainbow trout and Snake River cutthroat trout in the segment of the New Fork River that flows through the PAPA had declined relative to previous years. Conversely, the abundance of brown trout had increased in 2001. While rainbow and Snake River cutthroat trout spawn in the spring, brown trout are fall spawners (Baxter and Stone, 1995). Declines of rainbow and Snake River cutthroat trout in the New Fork River may be related to the increase of brown trout. Drought conditions through 2003 may have influenced the population of some game fish. The parasitic infection, whirling disease, was first documented in the New Fork River in 1998. Brown trout have been documented to be more resistant to whirling disease than rainbow trout (Hedrick et al., 1999) which may have also influenced the increased proportion of browns to rainbows in the New Fork River. Brown trout and mountain whitefish were sampled in the New Fork River during 2003 but tested negative, and the extent of the disease among game fish has not been determined.

Rainbow trout and cutthroat trout spawn in late May to early June, and have been known to hybridize (Henderson et al., 2000). This time period coincides with the greatest discharge period of the New Fork River (Figure 3.22-4) which leaves rainbow and cutthroat redds especially susceptible to increased sedimentation loads. Increased sedimentation poses a threat to trout redds by smothering the eggs and can limit the ability of trout to reproduce naturally (Lisle, 1989).

Surveys for native non-game fish in the Green River drainage began in 2003 with primary emphasis on the status and distribution of the bluehead sucker, flannelmouth sucker, and roundtail chub (WGFD, 2006b). So far, only the flannelmouth sucker has been found in the Green River but none of the three species - bluehead sucker, flannelmouth sucker, and roundtail chub - has been documented in the New Fork River or its tributaries near the PAPA. Bluehead suckers and roundtail chubs have been found downstream of the PAPA, including the Big and Little Sandy rivers and Blacks Fork drainage. Other native non-game species have been collected in the Green River, upstream and downstream of the confluence with the New Fork River (Table 3.22-15). Though native to Wyoming, white suckers are not native to the Green River drainage and have hybridized with native flannelmouth suckers. Hybridization by non-native species is one threat to native species in the Green River drainage.

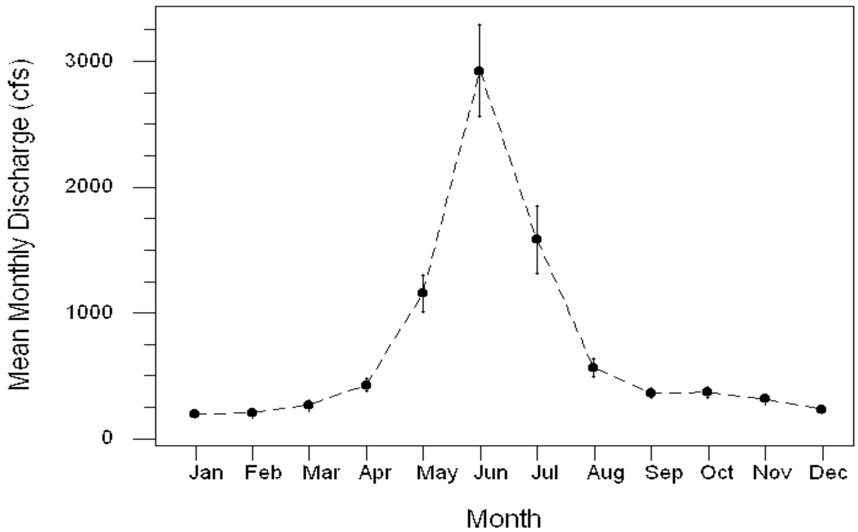


Figure 3.22-4
Mean Monthly Discharge in Cubic Feet per Second or cfs (with 95% Confidence Intervals) in the New Fork River (USGS Gauge 09205000) near Big Piney, Wyoming Averaged from 1954 to 2006

Table 3.22-15
Native, Non-Game Fish Documented in River Segments of the Green River Proximate to the PAPA[1]

Common Name Scientific Name	Segment from Confluence with New Fork River	
	Downstream	Upstream
Mountain Sucker *Catostomus platyrhynchus*	present 2002	present 2003
Flannelmouth Sucker Catostomus latipinnis	present 2002	present 2003
White Sucker *Catostomus commersoni*	present 2002	present 2003
Flannelmouth x White Sucker hybrid	-	present 2003
Redside Shiner *Richardsonius balteatus*	present 2002	present 2003
Speckled Dace *Rhinichthys osculus*	present 2002	present 2003
Utah Chub *Gila atraria*	present 2002	-
Fathead Minnow *Pimephales promelas*	present 2002	-
Mottled Sculpin *Cottus bairdi*	present 2002	present 2003

[1] Source: WGFD, 2003a and 2004d.

The condition of the riparian component of aquatic habitat along the New Fork River is a concern. Big game browsing appears to limit recruitment of mature riparian trees, principally willows and cottonwoods (WGFD, 2003a). Riparian trees provide shade, instream detritus, and streambank stability, all of which are important to sustain aquatic resources.

3.22.2 Pipeline Corridors and Gas Sales Pipelines

Wildlife species known to occur on lands crossed by the proposed corridor/pipeline alignments include a variety of common mammals, wild horses, aquatic species, and migratory birds common to sagebrush-steppe, grassland, and wetland riparian community types, similar to wildlife that occur in the PAPA.

Pronghorn habitat for the Sublette and Carter Lease herds is crossed by the existing pipeline corridors, as well as the proposed corridor/pipeline alignments. The proposed corridor/pipeline alignments would cross crucial winter, crucial severe winter relief, spring/summer/fall, and year-long ranges of the Sublette and Carter Lease herds north and south of the Green River and at the southern terminus near Granger, respectively (Frost, 2006 and Lockwood, 2006). The proposed corridor/pipeline alignments would cross yearlong, winter/yearlong, and winter ranges for mule deer (Fralick, 2005). Approximately 2 miles of elk severe winter relief area would be crossed on the south side of the Green River, within the BFGC and the OPC. Approximately 1 mile of moose winter/yearlong and approximately 2 miles of moose yearlong habitat would be crossed by the proposed corridor/pipeline alignments. Habitats within the proposed corridor/pipeline alignments are not known to support populations of elk and moose, although, individuals are infrequently observed in the vicinity of the proposed corridor/pipeline alignments (Fralick, 2005).

Greater sage-grouse leks, within and near the existing pipeline rights-of-way and proposed corridor/pipeline alignments have been identified by the BLM. Five greater sage-grouse leks have been identified within 2 miles of the proposed corridor/pipeline alignments in Sublette County.

Sagebrush steppe habitats along the proposed corridor/pipeline alignments are known to support several migratory and non-migratory bird species. These species include ferruginous hawk, Swainson's hawk, golden eagle, mountain plover, greater sage-grouse, mountain plover, Brewer's sparrow, sage sparrow, McCown's longspur, loggerhead shrike, and the lark bunting.

Grasslands and short-grass prairie habitat types are very limited along the proposed corridor/pipeline alignments and are primarily restricted to road-side ditches and areas of grazing or past disturbance where encroachment by shrubs has not occurred. This habitat type supports several migratory bird species, such as long-billed curlew, Brewer's sparrow, lark bunting, McCown's longspur, short-eared owl, burrowing owl, upland sandpiper, mountain plover, golden eagle, ferruginous hawk, and Swainson's hawk. Due to the limited expression of this habitat type, migratory bird species that are grassland obligates are not likely to be present along the proposed corridor/pipeline alignments.

Wetland and riparian habitats are very limited within the proposed corridor/pipeline alignments. Emergent wetland vegetation is present along the river banks of the Blacks Fork and Green rivers. Riparian habitats are not present at the proposed crossing locations of these rivers. The proposed crossing location of the New Fork River supports emergent wetlands within the flood plain as well as forested riparian habitat adjacent to the proposed corridor/pipeline alignments. This habitat type may support a number of avian species near the proposed corridor/pipeline alignments, such as red-tailed hawk, osprey, and bald eagle.

The Little Colorado Desert Wild Horse Herd Management area overlaps with approximately 23 miles of the proposed corridor/pipeline alignments. These horses are managed as an important part of the natural system under the multiple-use concept since 1971, when the Wild Free-Roaming Horses and Burro Act of 1971 was passed (Dunder, 2006).

The Green River, Blacks Fork River, and New Fork River are all known to support fisheries. The Green River below the Fontenelle Dam supports brown, rainbow, and cutthroat trout.

Kokanee salmon spawn in October downstream of the Fontenelle Dam. The Green River is classified as a Class 2 trout fishery, which is a fishery of statewide importance. The Blacks Fork is classified as a Class 4 trout fishery. It is a fishery of local importance, but normally incapable of supporting pressure from substantial fishing (WGFD, 1991). The New Fork River supports both rainbow and brown trout.

3.23 HAZARDOUS MATERIALS

Hazardous materials that would be present in the PAPA include those used and produced in association with natural gas drilling, completion, and production. These substances and their current management protocol are discussed in detail in the Hazardous Materials Management Summary (Appendix 12).