Chapter 3
Affected Environment

3.1 INTRODUCTION

This chapter describes the condition of the existing human and natural environment in the PAPA and the degree specific resources have been affected by natural gas development. Relevant management objectives that 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, 2006b). None of the management objectives included in the PAPA DEIS (BLM, 1999a) has changed. Relevant management objectives advanced by 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 these two RMPs has changed; however, the Kemmerer RMP is 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 that critical element or resource. For resources where minor impacts are expected to occur, only a brief description is provided. For resources that are expected to be impacted significantly by the alternatives, more detailed information is provided following 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. The emphasis in the following discussion is on information and understanding of 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 that contains 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 a number of resources overlap. For instance, it is common on the Mesa to have areas located within mule deer, greater sage-grouse, sensitive viewshed, and sensitive soil SRMZs. To address the overlapping SRMZs, the BLM divided the entire PAPA into nine distinct MAs. MA 1 through MA 8 apply only to federal lands and minerals. All nonfederal lands and minerals were combined into MA 9. The MAs and limits to surface disturbance that were 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. These are the basis for predicting future impacts associated with each alternative analyzed in Chapter 4.

Surface disturbance (the area in acres) by wellfield development was mapped using QuickBird satellite imagery over the entire PAPA. Surface disturbance for 2006 is identified separately in this chapter because the 2006 disturbance is projected by the Operators rather than digitized as actual disturbance on the ground.

Before issuance of the PAPA ROD (BLM, 2000b), approximately 7,467 acres had been disturbed in the PAPA, primarily concentrated on private lands and mostly associated with residential areas, recreational facilities, agricultural operations, and the Wenz Field airport. This disturbance is not associated with natural gas development in the PAPA and is not discussed further in this chapter. As of December 2005, there was a total of 4,679 acres of natural gas related disturbance in the PAPA. Of this, 561 acres were disturbed before issuance of the PAPA ROD and 4,118 acres were disturbed subsequent issuance of the PAPA ROD. These estimates are initial disturbance and do not account for reclamation. The Operators are projecting an additional 381 acres of wellfield disturbance in 2006, for an estimated total of 5,059 acres, which is 2.6 percent of all lands in the PAPA.

As a result of the proposed increase in natural gas production, the BLM, in consultation with the Operators, has identified three potential corridors for pipelines that would carry hydrocarbon products from the PAPA to processing plants in southwestern 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 then they diverge south of the Bird Canyon Compressor Station. The affected environment for the proposed corridor/pipeline alignments is also discussed below.

3.2 LAND AND MINERAL OWNERSHIP

Federally managed lands and minerals in the PAPA compose approximately 79.3 percent of lands while privately owned lands and minerals account for an additional 11.1 percent. Approximately 4.9 percent of all lands in the PAPA are composed of state owned lands and minerals while the remaining 4.7 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).

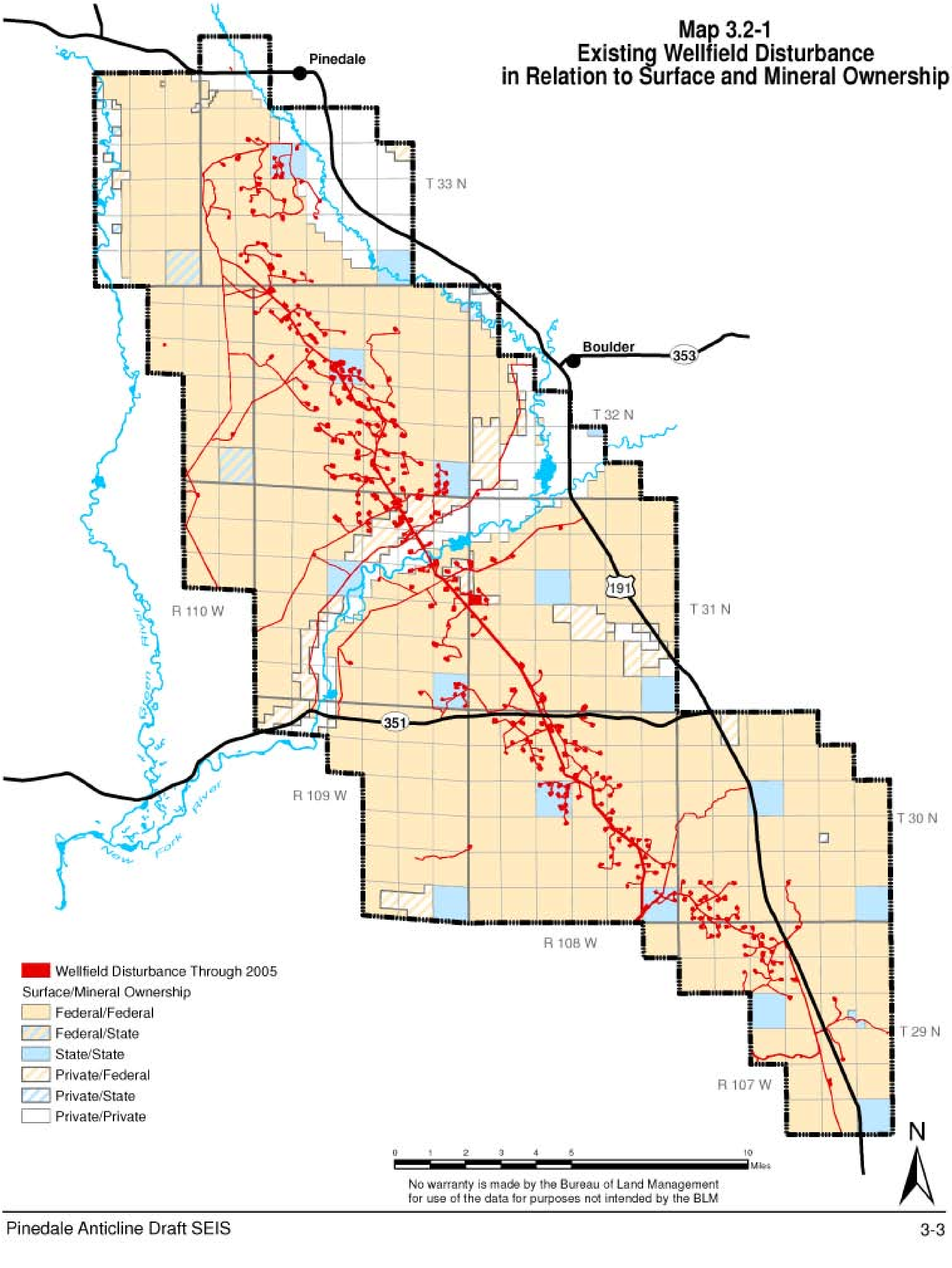
Map 3.2-1
Existing Wellfield Disturbance
in Relation to Surface and Mineral Ownership
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Surface/Mineral Ownership
Federal/Federal
Federal/State
State/State
Private/Federal
Private/State
Private/Private
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
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Table 3.2-1
Estimated Existing Wellfield Disturbance in Relation to Land and Mineral Ownership

Management/Ownership Category	Surface Area in the PAPA (acres)	Percent	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbed
Federal Surface/Federal Minerals	156,992	79.3	3,672.3	308.6	3,980.9	2.5
Federal Surface/State Minerals	1,279	0.6	0.00	0.0	0.0	0.0
State Surface/State Minerals	9,801	4.9	490.3	17.4	507.7	5.2
Private Surface/Private Minerals	21,896	11.1	218.4	16.9	235.3	1.1
Private Surface/State Minerals	339	0.2	0.0	0.0	0.0	0.0
Private Surface/Federal Minerals	7,727	3.9	297.5	38.0	335.5	4.3
Total	**198,034**	**100.0**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

As stated in the previous section, there were 4,679 acres of wellfield disturbance in the PAPA (2.4 percent) through December 2005 (Table 3.2-1). In 2006, the operators are proposing to disturb an additional 381 acres. At the end of 2006, an estimated 5,060 acres (2.6 percent) of the PAPA will have been disturbed by natural gas related development. Most surface disturbance, since issuance of the PAPA ROD, has been on Federal Surface/Federal Minerals lands.

3.3 CLIMATE

The climate in the region of 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, 2006). 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 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
Total Precipitation (inches in Water Year)	10.58	5.45	6.26	8.00	11.29	11.78
Total Snowfall (inches October-April)	57.87	43.54	34.91	49.01	58.89	53.02
Average Monthly Temperature (°F)	35.84	36.06	35.04	36.82	34.61	36.40
Average Minimum Monthly Temperature (°F)	19.67	18.62	17.79	20.26	18.63	20.40
Average Maximum Monthly Temperature (°F)	52.02	53.36	52.28	53.37	50.59	52.40

[1] Source: Western Regional Climate Center, 2006.

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. Total snowfall (October through April) estimated in the PAPA has been below the 30-year average of 58 inches since 1987 except during winter 2003-2004. Maximum monthly temperatures, averaged by water year, have generally been above the 30-year average (Table 3.3-1).

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 America 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 America, 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 America, 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, inhibiting 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 America, 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 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 U.S. 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] U.S. Census Bureau, 2006.
[2] This table uses US Census Bureau statistics which, due to rounding, may total slightly more or less than 100%.
[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. The discussion is for the proposed development within the PAPA and for the proposed corridor/pipeline alignments.

3.5.1 Socioeconomic Trends

Sublette, Sweetwater, and Lincoln counties are primarily rural, and their sparse population historically relied on livestock ranching (Rosenberg, 1990; Blevins et al., 2004; and BLM, 2006a). While ranching remains culturally important in southwestern 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 2004, 784 workers were employed in mineral development, 580 in travel/tourism, and 390 in agriculture in Sublette County. That same year in Lincoln County, 688 workers were employed in agriculture, 684 in mineral development, and 590 in travel. In Sweetwater County, an estimated 4,391 workers were employed in mineral development, 1,820 in travel/tourism, and 195 in agriculture in 2004 (U.S. Department of Commerce, 2006 and Dean Runyan Associates, 2005).

The significance of oil and gas revenues to the region's economy has increased and is expected to grow (BLM, 2006a). 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, 2006). 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 the Wyoming state average (Table 3.5-2).

Table 3.5-1
Total Assessed Valuation and Assessed
Valuation Indices, Southwestern Wyoming from 2000 to 2005

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
Source: Wyoming Department of Revenue, 2006.								

Table 3.5-2
Per-Capita Assessed Valuation from Oil and Gas Production Facilities, Southwestern Wyoming from 2000 to 2005

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

Source: Wyoming Department of Revenue, 2006.

In 2004, per-capita sales tax collections were $745 in Lincoln County, $3,856 in Sublette County, and $1,362 in Sweetwater County. The average Wyoming per-capita sales tax collections are $723 (Coupal et al., 2006).

Oil and gas exploration and drilling operations in southwestern Wyoming have been cyclical in nature. During the 1970s, as activity increased in southern Sublette County, employment in the oil and gas sector steadily grew. Employment spiked in the early 1980s when natural gas processing plants were built in southwestern Wyoming but employment dropped in the mid-1980s. There was gradual job growth in the oil and gas sector in southwestern 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 (Table 3.5-3). Average annual earnings per development job ($49,372) and average earnings per production job ($52,241) are higher than wages paid in other employment sectors (Jacquet, 2006). Employment related to natural gas development in the PAPA constitutes an increasing component of total regional employment from 2000-2005 (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 both sides of 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, 2006b). 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 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 2005

PAPA Related Data	2000	2001	2002	2003	2004	2005
Resource Development Phase:						
Wells Drilled [1]	2	40	59	77	122	120
Wells Completed [2]	2	39	58	75	119	117
Per-well employment: drilling	34.5	34.5	34.5	34.5	34.5	34.5
Per-well employment: completion	16.3	16.3	16.3	16.3	16.3	16.3
Total Development Employment	**103**	**2,015**	**2,997**	**3,875**	**6,148**	**6,045**
Per-well earnings: drilling	$1,726,956	$1,726,956	$1,726,956	$1,726,956	$1,726,956	$1,726,956
Per-well earnings: completion	$779,512	$779,512	$779,512	$779,512	$779,512	$779,512
Total Development Earnings	**$5,101,498**	**$99,479,208**	**$147,943,438**	**$191,306,170**	**$303,539,123**	**$298,437,625**
Average earnings per development job	$49,372	$49,372	$49,372	$49,372	$49,372	$49,372
Resource Production Phase:						
Natural Gas Production (MMSCF)	8,195	14,946	41,910	80,504	136,330	179,160
Per MMSCF employment	0.002008	0.002008	0.002008	0.002008	0.002008	0.002008
Total Production Employment	**16**	**30**	**84**	**162**	**274**	**360**
Per MMSCF Earnings	104.90	$104.90	$104.90	$104.90	$104.90	$104.90
Total Production Earnings	$859,668	$1,567,866	$4,396,327	$8,444,871	$14,300,972	$18,793,907
Average earnings per production job	$52,241	$52,241	$$52,241	$52,241	$52,241	$52,241

[1] Assumes 2.5 percent of wells are dry holes.
[2] WOGCC, 2006.

Table 3.5-4
Per-Capita Share of Total Regional Employment Including the Contribution by the PAPA

Region	2000	2001	2002	2003	2004	2005 (estimated)
Lincoln County	8,114	8,434	8,517	9,311	9,292	9,069
Sublette County	3,977	4,251	4,482	4,704	5,204	6,682
Sweetwater County	24,249	24,493	24,118	25,017	26,033	27,907
Total Tri-County Employment	36,340	37,178	37,117	39,032	40,529	43,658
Percent employed in the PAPA	0.3%	5.5%	8.3%	10.3%	15.8%	14.7%

Source: U.S. Department of Commerce, 2006.

The production from the PAPA represents 5.96 percent of Wyoming's natural gas production. The PAPA is the third largest oil and gas production field in Wyoming (WOGCC, 2006). The three-county region produces 19.31 percent of the oil produced in Wyoming and 53.97 percent of the natural gas produced in Wyoming (Table 3.5-5).

Table 3.5-5
Oil and Gas Production in Lincoln, Sublette, and Sweetwater Counties, 2004

County	Producing Wells	Oil (BBLS)	Percent of Wyoming's Oil Total	Natural Gas (MCF)	Percent of Wyoming's Gas Total
Lincoln	1,123	749,760	1.45	81,275,331	4.22
Sublette	2,339	4,698,953	9.10	726,051,744	37.66
Sweetwater	2,501	4,523,944	8.76	232,993,490	12.09
Total	**5,963**	**9,972,657**	**19.31**	**1,040,320,565**	**53.97**
Source: WOGCC, 2006.					

3.5.2 Population

The population of southwestern Wyoming is growing (Table 3.5-6). From 2000 to 2005, Sublette County grew an estimated 17 percent (1,006 people); Lincoln County grew an estimated 10 percent (1,426 people); and Sweetwater County grew less than 1 percent (362 people), compared with 3.1 percent growth for Wyoming and 5 percent growth for the United States. Census statistics underestimate the pace of growth in southwestern Wyoming because the statistics fail to recognize the increasing presence of transient workers who consider residences outside the counties their primary homes (Blevins et al., 2004). Furthermore, these data neither reflect growth which occurred in 2006, nor forecast the impacts of increased drilling activity.

Table 3.5-6
Population Estimates in Southwestern Wyoming from 2000 to 2005

Location	2000	2004	2005	Percent Change 2000-2004	Percent Change 2000-2005
Lincoln County	14,573		15,999	0	10
Afton	1,797	1,818	NA	1	0
Kemmerer	2,651	2,561	NA	-3	0
LaBarge	431	NA	NA	0	0
Opal	102	NA	NA	0	0
Sublette County	5,920		6,926	0	17
Big Piney	408	444	455	9	0
Boudurant	155	NA	NA	0	0
Boulder	30	NA	NA	0	0
Cora	76	NA	NA	0	0
Daniel	89	NA	NA	0	0
Marbleton	720	789	811	10	0
Pinedale	1,412	1,575	1,658	12	0
Sweetwater County	37,613		37,975	0	<1
Eden	388	NA	NA	0	0
Farson	242	NA	NA	0	0
Green River	11,808	11,807	NA	0	0
Rock Springs	18,708	18,746	NA	<1	0
Wyoming	493,782		509,294		
Source: U.S. Census Bureau, 2006. NA = not available					

In 2000, second homes in Sublette County were 26.2 percent of the total housing units, with 13.4 percent and 1.5 percent in Lincoln County and Sweetwater County, respectively. Southwestern Wyoming has a higher rate of second home ownership than the state as a whole (5.5 percent) (Taylor and Lieske, 2002).

Between 2000 and 2005, 71 percent of Lincoln County's growth and 90 percent of Sublette County's growth was from immigration rather than natural increase, contrasted with 26 percent immigration for Wyoming as a whole. Sweetwater County experienced an estimated net emigration of 1,118 people, and its population growth was entirely attributed to natural increase (births exceeding deaths).

Populations are expected to continue to grow in southwestern Wyoming in the second half of this decade. In late 2005, 524 natural gas industry workers in the PAPA and Jonah Field Project Area were casually surveyed. Almost half of the respondents (212) considered themselves nonresidents, and 64 percent of these nonresidents (136 individuals or families) said they were considering permanent relocation to the area. Respondents were more interested in moving to Sublette County (especially Pinedale and Boulder) than Sweetwater County (Sublette SE, 2006). Forecasts of population for southwestern Wyoming are presented in Table 3.5-7.

Table 3.5-7
Population Forecasts for Selected Locations in Southwestern Wyoming from 2006 to 2020

Location	2006 Forecast	2010 Forecast	2015 Forecast	2020 Forecast
Lincoln County	16,195	16,991	18,111	19,293
Afton	1,913	2,007	2,139	2,279
Alpine	742	779	830	884
Cokeville	528	554	591	629
Diamondville	748	785	837	891
Kemmerer	2,746	2,881	3,071	3,271
La Barge	449	471	502	535
Opal	106	111	119	127
Thayne	363	381	406	433
Sublette County	7,112	7,741	8,638	9,634
Big Piney	483	525	586	654
Marbleton	854	930	1,037	1,157
Pinedale	1,681	1,829	2,041	2,277
Sweetwater County	38,300	38,558	39,029	39,485
Bairoil	98	99	100	101
Granger	148	149	151	153
Green River	11,977	12,057	12,205	12,347
Rock Springs	19,004	19,132	19,366	19,592
Superior	246	247	250	253
Wamsutter	269	270	274	277
TOTAL	**61,606**	**63,290**	**65,778**	**68,413**
Source: Wyoming Department of Administration and Information, 2006a.				

3.5.3 Employment and Income Level

Southwestern Wyoming's recent unemployment data are mixed. Sublette County has experienced lower unemployment rates than the State of Wyoming, while state unemployment levels were among the lowest in the country from 2000 to 2005 (Table 3.5-8). Lincoln and Sweetwater counties experienced unemployment rates above both state and national levels until 2004 and 2005, when unemployment rates in both counties dropped due to tightening labor markets.

Table 3.5-8
Comparative Unemployment Levels (percent)
in Southwestern Wyoming and the United States from 1999 to 2005

Year	Lincoln County	Sublette County	Sweetwater County	Wyoming	United States
1999	6.2	3.7	6.2	4.9	4.2
2000	5.1	2.5	4.9	4.0	4.0
2001	5.0	1.9	4.4	3.6	4.7
2002	5.9	2.5	4.5	4.0	5.8
2003	5.8	2.7	4.0	4.1	6.0
2004	3.9	2.3	3.4	3.9	5.5
2005	3.9	1.8	3.0	3.6	5.1
July, 2006	2.3	1.8	3.0	3.6	5.1
Source: Wyoming Department of Employment, 2006.					

Per-capita income in Sublette County in 2000 was higher than in Lincoln and Sweetwater counties and higher than the Wyoming average (Table 3.5-9). In 2000, the median household income of each of the three counties exceeded the state average, and Sweetwater County's median household income exceeded the U.S. average. The Housing and Urban Development Agency's income limits were used to estimate growth in median household income from 2000 to 2006. Estimated median household income in Sublette County for 2006 was $59,400, an increase of 42 percent since 2000 (in 2000 dollars). Based on this estimate, Sublette County's median household income is now ranked fifth in the state (Sublette SE, 2006).

Table 3.5-9
A Comparison of Household and Per-Capita Income Statistics
for Southwestern Wyoming, and the United States in 2000

Parameter	Lincoln County	Sublette County	Sweetwater County	Wyoming	United States
Median household income	$40,794	$39,044	$46,537	$37,892	$41,994
Per capita income	$17,533	$20,056	$19,575	$19,134	$21,587
Families below the poverty line	6.4%	7.4%	5.4%	8.0%	9.2%
Individuals below the poverty line	9.0%	9.7%	7.8%	11.4%	12.4%
Source: U.S. Census Bureau, 2006.					

In 2004, the average wages per job in Sublette and Sweetwater counties exceeded the Wyoming average (Table 3.5-10). For the period 1999 to 2004, average wages per job increased 19.7 percent in Lincoln County, 29.7 percent in Sublette County, and 15.6 percent in Sweetwater County, compared with an 18 percent increase for Wyoming.

Table 3.5-10
Average Wages per Job, in 2004 Dollars,
for Lincoln, Sublette, and Sweetwater Counties, 1970 -2004

	1970	1980	1990	1999	2000	2001	2002	2003	2004
Lincoln County	$6,401	$15,130	$20,150	$24,456	$25,072	$25,931	$27,618	$30,120	$30,438
Sublette County	$5,897	$13,311	$17,628	$22,310	$24,697	$25,479	$27,756	$29,635	$31,715
Sweetwater County	$6,334	$18,933	$25,629	$32,648	$33,839	$35,654	$36,193	$37,382	$38,698
Wyoming	$6,070	$15,316	$19,844	$25,561	$26,602	$27,810	$28,838	$29,785	$31,179
Source: U.S. Dept. of Commerce, 2006.									

There is a group of individuals with unearned income (real dividends, interest, and rent) who reside in the three-county region. Some of these residents are retirees who have immigrated to the area. Figure 3.5-1 shows that there has been a slight decline in unearned income levels in the three-county region during the period 1999 to 2004, a trend which is more pronounced in Sweetwater and Lincoln counties than in Sublette County.

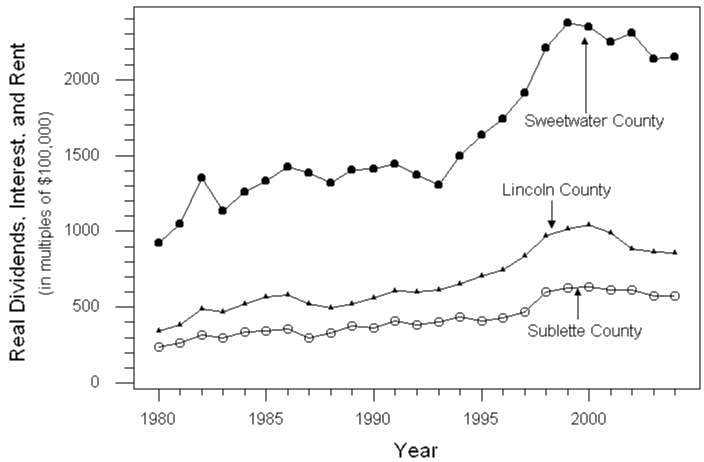


Figure 3.5-1
Real Dividends, Interest, and Rent in Lincoln, Sweetwater, and Sublette Counties for the period 1980-2004 (U.S. Dept. of Commerce, 2006)

The overall cost of living is 16 percent higher in Sublette County and 5 percent higher in Sweetwater County than in the rest of the State of Wyoming (Table 3.5-11). The overall cost of living in Sublette County is the second highest in Wyoming (behind Teton County), and the overall cost of living in Sweetwater County is the fourth highest in the state. The overall inflation rate for the southwestern region of Wyoming in the fourth quarter of 2005 was 8.3 percent, compared with 5 percent for Wyoming as a whole (Wyoming Department of Administration and Information, 2006a).

Table 3.5-11
A Comparison of Cost of Living Index Statistics for Southwestern Wyoming and the State of Wyoming in the Fourth Quarter, 2005[1]

County	All Items	Food	Housing	Apparel	Transportation	Medical	Recreation & Personal Care
Lincoln	90	88	83	98	101	86	107
Sublette	116	105	125	126	101	107	117
Sweetwater	105	97	112	92	101	107	95
Wyoming State Average	100	100	100	100	100	100	100

[1] an index value of 100 = the state average.
Source: Wyoming Department of Administration and Information, 2006a.

3.5.4 Growth in Economic Sectors

From 2001 to 2004, the mining sector in Lincoln County was the second fastest growing employer, growing at 56.9 percent, exceeded only by the education sector, which grew at 76.2 percent (Table 3.5-12). The industry with the fastest growing earnings was “Real estate and rental and leasing” (155.7 percent growth), followed by “Mining” (88.1 percent growth). The locus of most of the growth in Lincoln County’s real estate industry was Afton and the Star Valley in the northern part of the county. This area serves as a bedroom community for the tourism industry in neighboring Jackson Hole. It should be noted that this area is difficult to access from Pinedale and the PAPA because there are only secondary roads (not all-weather) traversing the Bridger-Teton National Forest.

In the North American Industry Classification System (NAICS) scheme, the category “Mining” includes oil and gas development and production. In 2004, “Oil and gas extraction” contributed $23.8 million or 42 percent, to the mining category; mining (except oil and gas) contributed $22.4 million, or 40 percent; and “Support activities for mining” contributed $10.1 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, 2006).

Sublette County’s economy as a whole grew faster than neighboring Sweetwater and Lincoln counties, with total industry earnings in the county growing by 57.2 percent in a 3-year period (Table 3.5-12). From 2001 to 2004, the mining sector was the fastest growing employer in Sublette County, increasing by 81.5 percent. The industry with the fastest growing earnings was “Agriculture” (242.7 percent growth), followed by “Mining” (111.4 percent growth), and “Real estate and rental and leasing” (100.5 percent growth). Even though the growth rate of earnings in agriculture led all others, employment in that sector decreased from 2001 to 2004. In terms of total earnings, the value of the mining sector (over $48 million) made it the largest industry in the county in 2004, comprising 28 percent of the county’s industry earnings (Table 3.5-12). In 2001, the category “Mining” (worth $22.8 million), was divided between the sub-categories “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 reported for Sublette County. In 2004, the exact amount contributed to the category “Mining” by “Oil and gas extraction” was not reported; however, $28.3 million was reported as “Support activities for mining” (59 percent of the total reported for the category “Mining”).

Sweetwater County does not disclose industry earnings for the general NAICS category “Mining”, nor does it disclose industry earnings for the subcategory, “Oil and gas extraction.” In 2004, however, reported industry earnings for another subcategory, “Mining (except oil and gas) were $188.8 million, 12 percent more than in 2001. “Mining (except oil and gas)” is mostly trona mining with some coal mining in Sweetwater County. The subcategory, “Support activities for mining”, earned $143.5 million in 2004, up 48 percent from 2001. Among reported industry earnings, the fastest growing category for the period 2001 to 2004 was “Educational services” at 62.5 percent, followed by “Administrative and waste services” (27.7 percent), “Construction” (23.1 percent), and “Transportation and warehousing” (22.3 percent). The fastest growing employer was “Education services” (25.3 percent increase in 3 years), followed by “Arts, entertainment and recreation” (up 18.6 percent) and “Transportation and Warehousing” (up 18.1 percent).

Table 3.5-12
Changes in Employment and Industry Earnings in Lincoln, Sublette, and Sweetwater Counties from 2001 to 2004 by NAICS Sector Classification

NAICS Sector	County	Employment			Industry Earnings		
		2001	2004	Percent Change 2001-2004	2001 (thousands)	2004 (thousands)	Percent Change 2001-2004
Agriculture	Lincoln	675	668	-1.0	$3,204	$3,599	12.3
	Sublette	396	390	-1.5	$2,165	$7,420	242.7
	Sweetwater	198	195	-1.5	$703	$258	-136.7
Agricultural services	Lincoln	87	83	-4.6	$1,157	$1,175	1.6
	Sublette	78	80	2.6	$788	$874	10.9
	Sweetwater	ND	ND	-	ND	ND	-
Mining	Lincoln	436	684	56.9	$29,898	$56,241	88.1
	Sublette	432	784	81.5	$22,820	$48,235	111.4
	Sweetwater	ND	ND	-	ND	ND	-
Utilities	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	24	-	ND	$1,972	-
	Sweetwater	ND	ND	-	ND	ND	-
Construction	Lincoln	1,227	1,412	15.1	$41,152	$56,427	37.1
	Sublette	472	617	30.7	$13,868	$24,136	74.0
	Sweetwater	1,811	2,037	12.5	$72,985	$89,819	23.1
Manufacturing	Lincoln	403	362	-10.2	$12,879	$9,839	-23.6
	Sublette	ND	92	-	ND	$1,988	-
	Sweetwater	1,426	1,176	-17.5	$110,430	$107,864	-2.3
Wholesale trade	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	16	-	ND	$401	-
	Sweetwater	ND	ND	-	ND	ND	-
Retail trade	Lincoln	1,009	1,025	1.6	$14,026	$15,850	13.0
	Sublette	442	484	9.5	$8,455	$9,545	12.9
	Sweetwater	2,928	3,038	3.8	$56,203	$64,357	14.5
Transportation and warehousing	Lincoln	220	215	-2.3	$10,030	$8,614	-14.1
	Sublette	81	112	38.3	$2,982	$3,438	15.3
	Sweetwater	1,111	1,312	18.1	$56,599	$69,207	22.3
Information	Lincoln	125	172	37.6	$3,387	$4,752	40.3
	Sublette	51	48	6.3	$1,132	$1,466	29.5
	Sweetwater	258	260	0.8	$6,334	$7,542	19.1
Finance and insurance	Lincoln	224	255	13.8	$7,237	$6,226	-14.0
	Sublette	81	118	38.3	$2,204	$4,033	83.0
	Sweetwater	540	571	5.7	$16,917	$19,324	14.2
Real estate and rental and leasing	Lincoln	324	382	17.9	$4,545	$11,621	155.7
	Sublette	175	194	10.9	$2,378	$4,767	100.5
	Sweetwater	675	761	12.7	$27,910	$31,354	12.3

NAICS Sector	County	Employment			Industry Earnings		
		2001	2004	Percent Change 2001-2004	2001 (thousands)	2004 (thousands)	Percent Change 2001-2004
Professional and technical services	Lincoln	231	293	26.8	$5,353	$6,849	27.9
	Sublette	237	248	4.6	$8,715	$9,874	13.3
	Sweetwater	616	678	10.1	$24,655	$29,499	19.6
Management of companies and enterprises	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	90	104	15.6	$4,613	$6,003	30.1
Administrative and waste services	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	799	879	10.0	$15,731	$20,083	27.7
Educational services	Lincoln	21	37	76.2	ND	$88	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	91	114	25.3	$769	$1,250	62.5
Health care and social assistance	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	1,196	1,298	8.5	$32,770	$37,646	14.9
Arts, entertainment, and recreation	Lincoln	124	138	11.3	$2,607	$3,354	28.7
	Sublette	95	127	33.7	$2,379	$3,324	39.7
	Sweetwater	284	337	18.6	$3,453	$4,167	20.7
Accommodations and food services	Lincoln	585	590	0.9	$5,227	$5,087	-2.7
	Sublette	386	450	16.9	$5,051	$6,810	34.8
	Sweetwater	2,102	2,295	9.2	$27,564	$32,539	18.0
Other services, except public administration	Lincoln	376	416	10.6	$4,702	$6,033	28.3
	Sublette	211	250	18.5	$2,434	$3,036	24.7
	Sweetwater	1,062	1,104	4.0	$19,683	$22,195	12.7
Government and government enterprises	Lincoln	1,556	1,633	4.9	$49,088	$61,808	25.9
	Sublette	702	803	14.4	$24,248	$32,783	35.2
	Sweetwater	4,210	4,209	0.0	$145,276	$171,218	17.9
TOTAL	**Lincoln**	**8,434**	**9,292**	**10.2**	**$221,637**	**$293,624**	**32.5**
	Sublette	**4,251**	**4,704**	**10.7**	**$108,944**	**$171,298**	**57.2**
	Sweetwater	**24,493**	**26,033**	**6.3**	**$984,951**	**$1,171,791**	**19.0**

Source: U.S. Department of Commerce, 2006.
Notes: All data include self-employed workers, ND = non-disclosure.

A profile of jobs covered by unemployment insurance, which estimates the rate of change in employment in Lincoln, Sublette, and Sweetwater counties from 2001 to 2005 (Table 3.5-13), indicates a robust growth rate of 52.5 percent in total employment in Sublette County, with 95.5 percent growth in natural resource and mining jobs. During that period, there was moderate job growth in Sweetwater County, with natural resource and mining jobs leading the pace at 34.8 percent growth, and slow overall job growth in Lincoln County but rapid growth in natural resource and mining jobs of 49.2 percent (U.S. Department of Labor, 2006).

Table 3.5-13
Employment in Lincoln, Sublette, and Sweetwater Counties from 2001 to 2005

Year	County	Total Jobs	Percent Change in Total Jobs	Natural Resource and Mining Jobs	Percent Change in Natural Resource and Mining Jobs
2001	Lincoln	5,757	N/A	445	N/A
	Sublette	2,617	N/A	445	N/A
	Sweetwater	18,876	N/A	3,610	N/A
2002	Lincoln	5,734	0.0	482	8.3
	Sublette	2,790	6.6	468	5.2
	Sweetwater	18,934	0.0	3,430	-0.1
2003	Lincoln	6,643	15.9	621	28.8
	Sublette	3,088	10.7	694	48.3
	Sweetwater	19,862	4.9	3,697	7.8
2004	Lincoln	5,981	-10.0	674	8.5
	Sublette	3,357	8.7	736	6.1
	Sweetwater	20,825	4.8	4,266	15.4
2005 (projected)	Lincoln	5,936	0.0	664	-1.5
	Sublette	3,992	18.9	870	18.2
	Sweetwater	22,218	6.7	4,866	14.1
Total From 2001 to 2005	**Lincoln**	**+179**	**3.1**	**+219**	**49.2**
	Sublette	**+1,375**	**52.5**	**+425**	**95.5**
	Sweetwater	**+3,342**	**17.7**	**+1,256**	**34.8**

Source: U.S. Department of Labor, 2006.
Note: These data include only jobs covered by unemployment insurance. August employment rates are higher than any other month of the year in southwestern Wyoming.

3.5.5 Housing

The U.S. Census Bureau estimates that between 2000 and 2004, the number of housing units increased by 10.8 percent in Lincoln County, 8.6 percent in Sublette County, and 1.0 percent in Sweetwater County. This compares to a 3.9 percent increase in Wyoming for the same period (Table 3.5-14). Growth in population has outpaced growth in housing in Sublette County for the period 2000-2005 (Sublette SE, 2006).

From 2000 to 2005, the cost of renting an apartment increased substantially in southwestern Wyoming (Table 3.5-15). Analyses of housing affordability suggest that it may be prohibitively expensive for those employed in the PAPA to move to the three-county region (Sublette SE, 2006). The increase was 61 percent for Sublette County, 55 percent for Lincoln County, and 40 percent for Sweetwater County (Table 3.5-15). During this same period, the cost of renting a house increased in Sublette County (41 percent) and Sweetwater County (39 percent) but decreased in Lincoln County (13 percent). The cost of renting a mobile home lot from 2000 to 2005 increased 37 percent in Sublette County, 13 percent in Lincoln County, and 9 percent in Sweetwater County. The rate of increase for renting a mobile home on a lot was even higher. Increases for 2000 to 2005 were 53 percent in Sweetwater County, 36 percent in Sublette County, and 20 percent in Lincoln County. A comparison between cost of living statistics in Lincoln, Sublette, Sweetwater, and the other 20 counties was included in the Jonah Infill Drilling FEIS (BLM, 2006a).

Table 3.5-14
Housing Unit Estimates in Lincoln, Sublette, and Sweetwater Counties and Wyoming for 2000-2004

Value	Lincoln County		Sublette County		Sweetwater County		Wyoming	
	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 Census	6,831	N/A	3,552	N/A	15,921	N/A	223,854	N/A
2001 Estimate	7,012	2.65	3,620	1.91	15,995	0.46	225,961	0.94
2002 Estimate	7,220	5.69	3,693	3.97	16,026	0.66	227,780	1.75
2003 Estimate	7,408	8.45	3,773	6.22	16,045	0.78	229,663	2.59
2004 Estimate	7,571	10.83	3,859	8.64	16,078	0.99	232,637	3.92
Source: U.S. Census Bureau, 2006.								

Table 3.5-15
Lincoln, Sublette, and Sweetwater Counties Average Rental Housing Costs from 2000 to 2005

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	$435
	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
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

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
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	$673	$214	$594
Source: Wyoming Department of Administration and Information, 2006a.					

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'). The data show some seasonality in vacancy rates, with tighter rental markets in June/July than in December, although these trends were less pronounced in Sublette and Sweetwater counties in 2004 and 2005. In December 2005, Sweetwater County had the tightest rental market in the three-county region, with a vacancy rate of 2.4 percent, followed by Sublette County (4.6 percent) and Lincoln County (10.2 percent). The vacancy rate for Sublette County in the first period of 2006 was estimated at 1.89 percent (Allen, 2006). It is noteworthy that in Sublette County in 2000, there were 930 housing units that were vacant for seasonal use, compared to seven available in the second half of 2005 (U.S. Census Bureau, 2006).

Table 3.5-16
Semiannual (Year with a and b) Rental Vacancy Survey for Lincoln, Sublette, and Sweetwater Counties from 2001 to 2005

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	NR
	Sweetwater	19	1,083	49	4.5
2002a	Lincoln	8	114	10	8.8
	Sublette	3	41	NR	NR
	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	19	1,083	49	4.5
2004a	Lincoln	9	176	12	6.8
	Sublette	6	59	1	1.7
	Sweetwater	29	1,369	12	0.9

Year	County	Sample	Total Units	Vacant Units	Percent Vacancy Rate
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
Source: Wyoming Housing Database Partnership, 2006.					

There is pressure on the housing rental market in the three-county region. Lincoln County has fewer rental units than Sublette or Sweetwater County; in 2002, 20 percent of its rental properties were vacant (1,349 units), probably due to growth in second-home ownership in the county (BLM, 2006a). In 2002, Sublette County had both the highest, officially-reported, vacancy rate in the three-county region (32 percent, 1,155 vacant units) and the least owner-occupied units (50 percent). There is a shortage of available housing in Sublette County according to the Sublette County Assessor's Office (BLM, 2006a). Furthermore, due to housing shortages in northern Sublette County, market demand is pushing up prices of current homes on the market. Numerous temporary housing projects and significant increases in construction of permanent housing in Sublette County have occurred (BLM, 2006a). An August 2006 plan to build a man camp in Farson (Lincoln County) was fought and defeated by local residents (Gearino, 2005). According to officially reported statistics, the housing market in Sweetwater County is the tightest in the three-county region (BLM, 2006a). Gearino (2005) attributed this phenomenon to the scarcity, and corresponding expensive housing in Sweetwater County.

The market is responding to increased demand for housing in the three-county area. Building permits and per-unit valuation of new construction have trended up from 2000 to 2005 in all three counties in southwestern Wyoming (Table 3.5-17). In Sublette and Sweetwater counties, the median sale prices of single-family homes have also trended up, at a pace exceeding the state wide trends (Sublette SE, 2006).

Table 3.5-17
Building Permits and Valuation, Lincoln, Sublette, and Sweetwater Counties from 2000 to 2005

Year	County	Authorized construction in permit issuing areas					Per-unit valuation, 1000s of real 2005 dollars
		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	150.61
	Sublette	54	0	0	0	54	146.40
	Sweetwater	36	0	0	5	41	150.42
2001	Lincoln	214	0	4	0	218	153.66
	Sublette	72	4	0	0	76	153.34
	Sweetwater	38	0	0	0	38	183.72
2002	Lincoln	192	0	4	8	204	157.70
	Sublette	74	6	8	0	88	160.51
	Sweetwater	48	0	0	0	48	165.76
2003	Lincoln	180	0	0	0	180	167.15
	Sublette	83	4	8	0	95	161.94
	Sweetwater	63	0	0	0	63	187.21

Year	County	Authorized construction in permit issuing areas					Per-unit valuation, 1000s of real 2005 dollars
		Single-family Units	Duplex Units	Tri- and Four-plex Units	Multi-family Units	Total Units	Single-family Units
2004	Lincoln	206	2	4	0	212	166.44
	Sublette	77	12	4	0	93	175.52
	Sweetwater	216	0	0	0	216	164.54
2005	Lincoln	229	6	0	0	235	158.58
	Sublette	99	0	0	0	99	173.17
	Sweetwater	203	0	0	0	203	145.03
Source: U.S. Census Bureau, 2006 and Wyoming Housing Database Partnership, 2006.							

3.5.6 Infrastructure

The three-county region 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.

3.5.6.1 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 also serviced by two bus lines, four car rental services and two taxi services.

3.5.6.2 Fire Protection Services

Fire protection is provided by four fire departments in Lincoln County, three fire departments in Sublette County, and ten in Sweetwater County (Capitol Impact, 2006). The 24-member Pinedale Volunteer Fire Department (PVFD) serves the PAPA (Mitchell, 2006). They purchased a new rescue truck in 2003 with town funds (drawing on tax revenues from the PAPA). The fire-fighting emergency response capabilities have been adequate to meet demands from the PAPA to date (Mitchell, 2006). A hazardous materials trailer was recently purchased for the PAPA, and they began using it during summer 2006. The Operators are responsible for responding to fires that may occur in the PAPA, while the PVFD would maintain a buffer perimeter around the fire (Mitchell, 2006).

3.5.6.3 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 the state that has sheriff services with no local police services. Since 2000, the Sheriff’s office has added eight officers, including detectives. There are currently 23 officers in Sublette County. They are currently trying to add a few more officers to handle vacancies, mostly created due to officers who are in the military reserves. A major challenge facing the Sheriff’s office is difficulty in keeping officers and other staff members, because wages and benefits paid by the oil and gas operators are higher than what the County pays (Hanson, 2006a). Sublette County Commissioners are sensitive to this issue and are working to raise wages. The Sheriff department’s current staffing is adequate to handle county traffic control including drunken driving issues. They are able to run more patrols of oil fields and have greater visibility in the community than they had prior to 2000. The PAPA does not pose as difficult a patrolling challenge as the Jonah Field Project Area because the PAPA is closer to Pinedale. The Sheriff's Department is well-supported and equipped to meet its current responsibilities (Hanson, 2006a).

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 growth in oil and gas activity. The City 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 (Kessler, 2006). In addition to a rise in index crimes (Sublette SE, 2006), there are increases in smaller crimes –such as drunkenness in public and traffic control issues – which require a large portion of officer's time. Recent data indicate that index crimes increased more than historical data would have predicted (Sublette SE, 2006). Rock Springs recently received approval to add six officers to their current roster of 44, but finding individuals and providing adequate training has proved difficult (Kessler, 2006). Of the 44 officers on payroll, 38 operate independently on patrol.

Drug use, in particular methamphetamine use, is an increasingly difficult and prevalent problem in the three-county region. Southwest Counseling Service in Rock Springs is the drug treatment facility that serves southwestern Wyoming (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 were allocated for community efforts to combat methamphetamine distribution and addiction.

3.5.6.4 Medical Services

The first call emergency medical services to the PAPA are provided by the Sublette Rural Health Care District (McGinnis, 2006). In 1999, the District's emergency medical crews were volunteers. The District has paid staff members comprising two crews with 24-hour coverage, including two crews from 5:00 a.m. till 8:00 p.m. There is more demand for services from Memorial Day to Labor Day and, accordingly, they add personnel. The District has six ambulances, all with four-wheel drive vehicles. They are currently constructing a four-bay ambulance barn in Pinedale and another two-bay barn in Sand Draw, closer to the PAPA. The emergency medical technicians are all highly trained. The District is fully staffed and equipped to meet emergency demands (McGinnis, 2006). The District and the Pinedale Clinic send dozens of referrals per week to the Memorial Hospital in Rock Springs (Belltran, 2006). Trauma victims from the PAPA are transported to hospitals in Salt Lake City by helicopter using Memorial Hospital resources. There has not been an increase in trauma incidents in the period 2000-2005 and they are equipped to meet the current demand. Most of the referrals from the PAPA to Memorial Hospital are broken bones, bruises, and lacerations. Memorial Hospital is not experiencing strain on its emergency services provision (Belltran, 2006).

In Lincoln County, two medical centers coordinate primary and urgent-care services. The South Lincoln Medical Center 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 are two satellite clinics, two family practice physicians, one physician's assistant, and one family nurse practitioner located in the southern part of the 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 in Alpine there is one clinic staffed by a family nurse practitioner. There are two nursing homes in Lincoln County.

In Sublette County, medical services include a clinic with two branches, two independent physicians, a physician's assistant, one dentist, ambulance service, and a nursing home with 107 rooms. The Pinedale Medical Clinic serviced approximately 13,203 patients in 2005 (Sublette County Rural Health Care District, 2006), up 9 percent from 12,000 patients in 2003 (BLM, 2006c). The Marbleton-Big Piney Clinic serviced approximately 6,000 patients in 2005 (Sublette County Rural Health Care District, 2006).

The main center for medical services in Sweetwater County is the Memorial Hospital in Rock Springs, with a 99-bed hospital facility that, in 2005, provided 22,000 days of emergency room care, 2,900 days of in-patient care, and 2,400 days of out-patient care. Memorial Hospital coordinates emergency care services for southwestern 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.

3.5.6.5 Lodging

Hotel and motel accommodations in Lincoln County include sixteen 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.

3.5.6.6 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 has two branches with 80,000 volumes total. The Sweetwater County Public Library has nine branches with 207,000 volumes total.

3.5.6.7 Schools

There are five school districts in the three-county region. Table 3.5-18 shows trends in school enrollments, 2000-2005, in the three-county region. Schools in Sublette County and Sweetwater CSD (Consolidated School District) #1 are experiencing increased enrollments, whereas in Lincoln County and Sweetwater ISD (Independent School District) #2 are experiencing declining enrollments.

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).

Sweetwater County ISD #2 (Green River) has 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, they have considerable room for expansion in the 7th through 12th grades (Van Mater, 2006). Sweetwater CSD #1 (Rock Springs) has seen recent increases in numbers of kindergarten through 6th grade students. They are not at capacity in their elementary schools but they are approaching it. They will be building a new kindergarten through 6th grade building in 3 years. They have plenty of 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).

Table 3.5-18
Trends in School Enrollment in Lincoln,
Sublette, and Sweetwater Counties from 2000 to 2005

	10/1/2000	10/1/2001	10/1/2002	10/1/2003	10/1/2004	10/1/2005
Lincoln #1	789	724	668	669	622	628
Sublette #1	639	630	671	689	701	763
Sublette #9	569	587	571	592	591	617
Sweetwater #1	4,665	4,401	4,264	4,193	4,197	4,240
Sweetwater #2	2,928	2,774	2,688	2,650	2,620	2,581
Source: Wyoming Department of Administration and Information, 2006b.						

Both Sublette County CSDs report effects on their enrollments from the development in the PAPA (Anschutz, 2006 and McAdams, 2006). Sublette CSD #1 is constrained for space in the middle school; they are currently building a second middle school, which will accommodate grades 5 and 6. Elementary schools are constrained for space; they will need to build a new elementary school within 5 years. The high school has space to expand. There were 232 enrolled at the end of the 2005-06 school year, and they expect 260 students for 2006-2007, but up to 300 could be accommodated (McAdams, 2006). Sublette CSD #2 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).

3.5.6.8 Communications

Communications in the three-county region consist of three weekly newspapers in Lincoln County, two weekly newspapers in Sublette County, and one weekly and one daily newspaper in Sweetwater County. In Lincoln County there are two radio stations, in Sublette County there are two radio stations, and in Sweetwater County there are six radio stations.

3.5.7 County and Local Government Revenues

A foundational source of revenue for the three-county region is sales taxes. All Wyoming counties have levied sales taxes since 1935. Lincoln County levies a 5 percent sales tax (4 percent is paid to the State; 1 percent is retained by the county). Kemmerer levies a 2 percent lodging tax. In 2005, sales tax collections from mining production ($2.3 million) represented 16 percent of total collections for Lincoln County ($14.7 million). Sales tax in Sublette County is 4 percent with a 3 percent lodging tax. In 2003, the largest source of sales tax revenue for Sublette County was from mining (51 percent). This markedly differs from the rest of Wyoming, where retail sales account for 45 percent of sales tax revenue. In Sublette County, 14 percent of sales tax revenues were from retail sales, 13 percent from services, and 12 percent from wholesale sales. Sales tax in Sweetwater County is 5 percent (4 percent is paid to the state; 1 percent is paid to Sweetwater County). Sweetwater County levies a 2 percent lodging tax. In 2005, sales tax collection from mining production ($9.2 million) represented 18 percent of total collections for Sweetwater County ($50.4 million). This represents sales tax collection on sales by the mining sector, not the sales tax paid by the mining industry.

Assessed valuation is the basis for levying property taxes and mineral severance taxes (Table 3.5-19). The 2005 assessed valuation in Sublette County was $2.9 billion, a six-fold increase since 2000. County revenues from mineral severance taxes and property taxes on oil and gas development in the PAPA, which are returned to the local government, are paid to Sublette County and its municipalities.

The federal government owns and manages 49 percent of land in Wyoming; including 75 percent of Lincoln County, 67 percent of Sublette County, and 69 percent of Sweetwater County. Federal lands are not subject to property taxes that support county governments and education. Since 1976, Congress has authorized federal land management agencies to share income with states and counties through its Payment In Lieu of Taxes (PILT) program. In 2005, in Lincoln County, $757,883 was returned to the county on 1,947,047 acres enrolled in the PILT program, an effective payment of $0.39 per entitlement-acre. In 2005 in Sublette County, $481,089 was returned to the county on 2,431,287 acres enrolled in the PILT program, an effective payment of $0.198 per entitlement-acre. In 2005 in Sweetwater County, $1,624,031 was returned to the county on 4,611,015 acres enrolled in the PILT program, an effective payment of $0.35 per entitlement-acre (Foulke et al., 2006a).

Sublette County and its municipalities receive three types of tax revenues based on oil and gas production in the PAPA: ad valorem taxes, severance taxes, and federal mineral royalties. Tax revenues for ad valorem and severance taxes are based on the previous year's production (Table 3.5-19).

Table 3.5-19
Production and Sales of Oil and Gas from the
PAPA Natural Gas Wells used to Estimate Revenues

Source	2000	2001	2002	2003	2004	2005
Production[1]						
Gas (MSCF)	8,195,121	14,946,294	41,909,699	80,504,011	136,,329,573	179,160,224
Oil (Bbls)	78,621	143,378	376,726	649,687	1,075,210	1,407,162
Sales/production Ratio[2]						
Gas	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%
Oil	100%	100%	100%	100%	100%	100%
Sales:						
Gas (MSCF)	7,231,375	13,188,610	36,981,118	71,036,739	120,297,215	158,090,982
Oil (Bbls)	78.621	143,378	376,726	649,687	1,075,210	1,407,162

[1] Tax revenue for ad valorem and severance taxes is based on the previous year's production.
[2] Source: Wyoming Department of Revenue, 2006 and WOGCC, 2006.

A severance tax is an excise tax imposed on removing, extracting, severing, or producing any mineral in Wyoming. An ad valorem tax is a tax on property which also applies to minerals in Wyoming. Estimated ad valorem and severance tax distributions to Sublette County from PAPA natural gas wells, from 2000 to 2005, are presented in Table 3.5-20. These ad valorem and severance taxes are paid to the State School Foundation Program (12 mills), and to Sublette County and its school districts.

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 3.5-21. Fifty percent of FMR are returned to the state, and a portion of that is then distributed to counties and towns. In 2005, Pinedale received $150,000 in federal mineral royalties; Marbleton received $84,000; and Big Piney received $54,000 (Lummis et al., 2005).

Table 3.5-20
Estimated Ad Valorem and Severance Tax Distributions to Sublette County from PAPA Natural Gas Wells from 2000 to 2005

Source	2001	2002	2003	2004	2005
Ad valorem taxes					
Rate[1] on gas per MSCF	$0.18	$0.10	$0.20	$0.25	$0.30
Rate[1] on oil per Bbls	$1.27	$1.34	$1.60	$2.11	$2.55
Ad valorem – Gas	$233,950	$3,698,112	$14,207,348	$30,074,304	$47,862,045
Ad valorem – Oil	$182,090	$504,813	$1,039,499	$2,268,693	$3,586,687
Ad valorem – Total	$2,556,040	$4,202,925	$15,246,847	$32,342,997	$51,448,732
Severance taxes					
Rate[1] on gas per MSCF	$0.15	$0.09	$0.18	$0.23	$0.29
Rate[1] on oil per Bbls	$1.11	$1.22	$1.52	$1.95	$2.19
Severance – Gas	$1,995,437	$3,324,603	$13,013,931	$28,017,221	$46,162,567
Severance – Oil	$159,322	$458,589	$984,731	$2,096,552	$3,081,685
Severance – Total	$2,154,758	$3,783,191	$13,998,661	$30,113,773	$49,244,251
[1] Source: Wyoming Department of Revenue, 2006.					

Table 3.5-21
Federal Mineral Royalties (FMR) to Wyoming from PAPA Natural Gas Wells

Source	2001	2002	2003	2004	2005
Rate[1] on gas per MSCF	$0.30	$0.12	$0.20	$0.16	$0.25
Rate1 on oil per Bbls	$1.41	$0.99	$1.33	$1.54	$1.84
FMR – Gas	$3,982,960	$4,604,149	$14,491,495	$19,307,703	$39,522,745
FMR- Oil	$201,876	$374,277	$861,160	$1,656,899	$2,594,807
FMR- Total	$4,184,836	$4,978,427	$15,352,655	$20,964,602	$42,117,552
[1] Mineral Management Services, 2005					

3.5.8 Natural Gas Prices

Increases in natural gas prices are one factor influencing Operator's decisions regarding the number of wells to drill and the level of production from existing wells. From 2000 to 2005, the average wellhead price paid for Wyoming natural gas has increased (Table 3.5-22).

Table 3.5-22
Average Prices Paid at the Wellhead, in Wyoming 2000 to 2005

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 Year to Date	$4.75
Source: DeBruin, 2005.	

3.6 TRANSPORTATION

3.6.1 Development Within the PAPA

The primary routes to, and main access through, the PAPA are U.S. Highway 191 and State Highway 351, respectively (see 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).

Table 3.6-1 provides length of roads and acreage of disturbance for roads within the PAPA. 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. Lengths and acreage of disturbance include collector roads existing before issuance of the PAPA ROD (BLM, 2000b) that have been subsequently upgraded and expanded.

Table 3.6-1
Existing Wellfield Roads Within the PAPA by Road Category

<table>
<tr><th rowspan="2">Category</th><th colspan="2">Existing Roads as of December 2005</th><th colspan="2">Roads Proposed in 2006</th><th colspan="2">Total Existing Wellfield Related Roads</th></tr>
<tr><th>Length (miles)</th><th>Area (acres)</th><th>Length (miles)</th><th>Area (acres)</th><th>Length (miles)</th><th>Area (acres)</th></tr>
<tr><td>Collector</td><td>66.7</td><td>419.0</td><td>0.00</td><td>0.00</td><td>66.7</td><td>419.0</td></tr>
<tr><td>Local</td><td>68.7</td><td>324.1</td><td rowspan="2">5.9</td><td rowspan="2">30.7</td><td rowspan="2">148.4</td><td rowspan="2">693.4</td></tr>
<tr><td>Resource</td><td>73.8</td><td>338.6</td></tr>
<tr><td>Total</td><td>209.2</td><td>1,081.7</td><td>5.9</td><td>30.7</td><td>215.1</td><td>1,112.4</td></tr>
</table>

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 2005, traffic volume had more than doubled to 1,450 vehicles per 24 hours, while truck traffic more than tripled to 380 trucks per 24 hours (Wyoming Department of Transportation – WDOT, 2005). 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 2,640 vehicles per 24 hours (330 trucks per 24 hours) in 2005 (WDOT, 2005). Table 3.6-2 summarizes average vehicles per day estimated for different road sections near the PAPA in 2000 and in 2005.

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 3.6-2
Average Number of Vehicles Per Day on Highways Used to Access the PAPA

Section Description	Section Milepost		Pre-ROD (July 2000)		Post-ROD (December 2005)	
	Begin	Length (miles)	All Vehicles	Trucks	All Vehicles	Trucks
U.S. Highway 191						
Sweetwater – Sublette County Line	51.62	21.33	1,500	240	2,920	640
Jct. Speedway Road	72.81	3.95	1,500	240	2,770	630
Jct. Route 1801 (WY 351)	76.75	7.75	1,300	160	1,910	270
Jct. Fish Hatchery Road	84.50	3.30	1,200	150	2,050	280
Jct. Route 1804 (WY 353)	87.80	4.99	1,600	170	2,450	310
Jct. Wenz Airport Road	92.80	2.70	1,700	180	2,640	330
Jct. County Road 221 East & West	95.50	3.00	1,800	190	3,260	360
Jct. County Road 121 East	98.50	0.49	1,900	210	3,970	380
Pinedale South Corp Limits	98.99	0.40	3,100	230	4,510	360
Jct. Fremont Lake Road	99.39	0.89	4,600	240	5,670	360
Pinedale West Corp Limits	100.27	0.76	3,000	230	5,330	340
Jct. County Road 144 North	101.03	4.51	2,400	240	3,600	320
Jct. Route 352 (WY 352)	105.54	4.93	1,900	230	2,370	210
State Highway 351						
Jct. Route 11 (U.S. 189)	0	12.91	640	110	1,450	380
Jct. County Road 136 North	12.91	11.27	280	40	1,070	360
Jct. Route 13 (U.S. 191)	0	6.70	400	50	650	30
Source: WDOT, 2005.						

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 is 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 were traveling 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 within the PAPA. Traffic information was gathered from November 15, 2005 through April 30, 2006 at an 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 3.6-3.

Table 3.6-3
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**

Questar funded a traffic study, beginning in mid-January and lasting through March 2006. Forty-four traffic counters were placed on roads 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 on roads to well pads without liquids gathering pipelines. Counters also documented traffic volume to 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 3.6-4). 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 3.6-4) 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 liquid gathering pipelines on daily traffic are evident from traffic counters placed on local roads and, especially, on resource roads (Table 3.6-5). Average daily traffic to well pads with liquid gathering pipelines is half the traffic to pads without.

Table 3.6-4
Traffic Counter Locations, Traffic Volumes, and Wellfield Components Accessed Beyond Each Counter on the North Anticline Road from mid-January through March, 2006

Distance (miles) of Counter to Paradise Road	Median Vehicle Round Trips per Day [1]	Pads Accessed [2]	Producing Wells Accessed [3]	Pads with Liquid Gathering Pipelines [4]	Wells with Liquid Gathering Pipelines[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 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 (2006).
[4] Questar (Wexpro) pads and wells were assumed to have liquid gathering lines; 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 3.6-5
Comparisons of Vehicle Traffic to Well Pads With and Without Liquid Gathering Systems and the Effects of Winter Drilling on Traffic Volume

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 Liquid Gathering System	3	2.67	1.67	1.60
With Liquid Gathering System	8	1.31	2.00	0.66
With Liquid Gathering System and Winter Drilling	2	66.25	4	16.56

Source: Western EcoSystems Technology, 2006.

3.6.1.2 Vehicular Accidents

The total number of traffic accidents and people injured or killed in Sublette County has increased annually from 2000 through 2005 (Table 3.6-6). In 2000, there were 271 total accidents, three fatalities, and 90 persons injured, compared to a total of 340 accidents, eight fatalities, and 106 persons injured in 2005. Table 3.6-6 summarizes the data collected from 2000 through 2005 for traffic accidents on roads adjacent to the PAPA.

Table 3.6-6
Number of Traffic Accidents on Roads Adjacent to the PAPA

Year	Persons Injured	Persons Killed	Property Damage Only	Injury Accidents	Fatal Accidents	Total Accidents
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

Source: Carpenter, 2006a.

From Interstate 80 to Daniel Junction, there were 449 accidents reported by the WDOT from 2001 through 2005 on U.S. Highway 189. Accident frequency along this section of road has remained fairly constant over the 4 years. There were increased vehicular accidents on other major routes to the PAPA during that same time. On U.S. Highway 191 between Rock Springs and Daniel Junction, accidents increased 150 percent from 142 in 2001 to 215 in 2005. A 100 percent increase in accidents was recorded along State Highway 351, connecting U.S. Highway 189 and U.S. Highway 191, where nine accidents were reported in 2001 and 18 accidents were reported in 2005.

WDOT (Carpenter, 2006a) 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 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 have increased (Table 3.6-7), WDOT's funding levels have remained constant over the past 5 years. Sublette County maintains the various county roads servicing the PAPA. The Operators are responsible for preventive and corrective maintenance of all BLM roads within the PAPA.

Table 3.6-7
Highway Maintenance
Expenditures (dollars) from 2000 through 2005

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 [1]	21,200	204,300 [1]
2005	156,300 [1]	28,100	65,800

[1] Includes chip sealing projects but not asphalt patching and snow plowing.
Source: WDOT, 2005.

3.6.2 Pipeline Corridors and Gas Sales Pipelines

A regional network of federal, state, county, and 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 pipeline route (see Map 2.4-1 in Chapter 2). In addition to federal and state highways, access to the corridor/pipeline alignments and 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 parallel or are adjacent to portions of the proposed corridor/pipeline alignments; but that 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

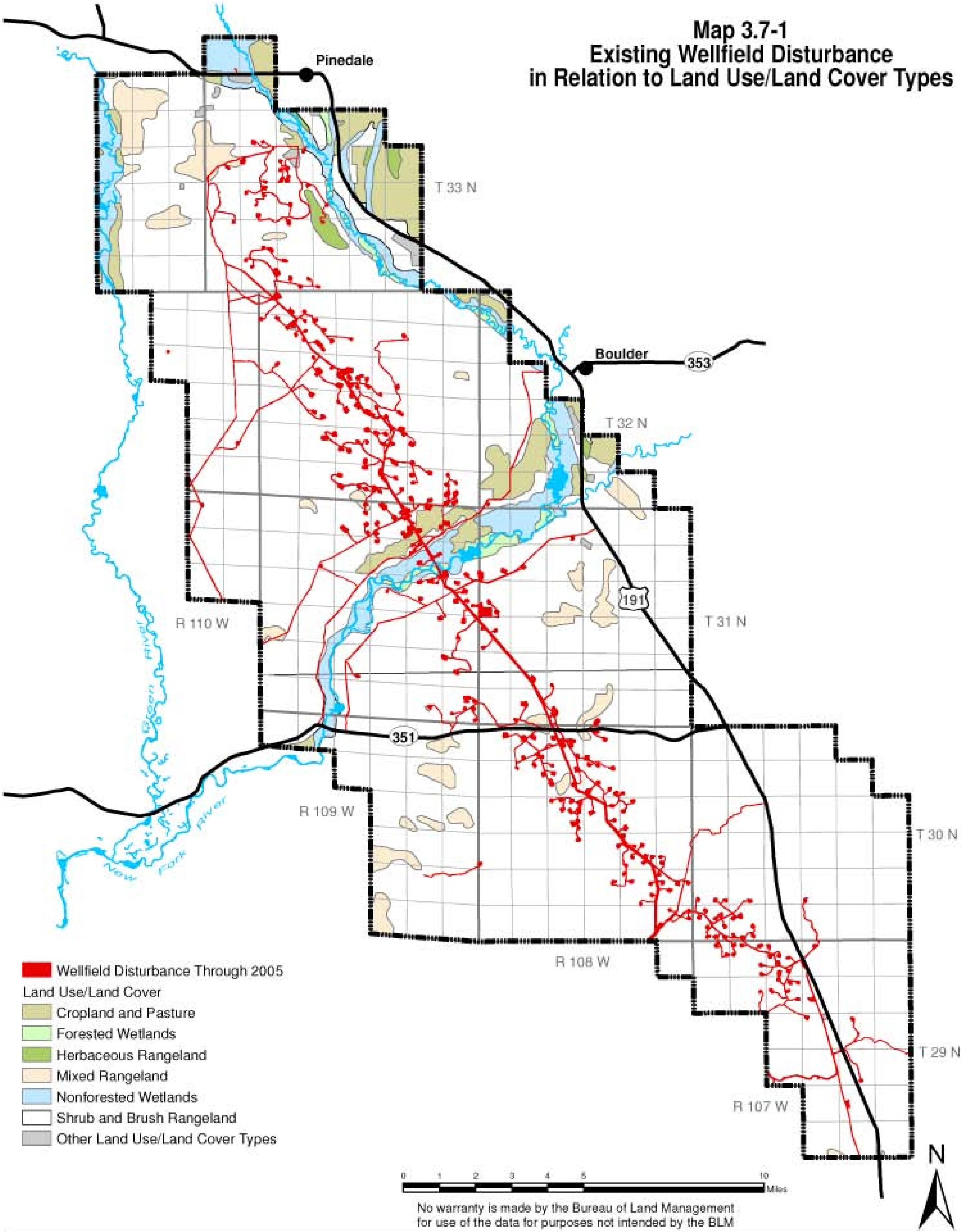
3.7.1 Development Within the PAPA

3.7.1.1 Land Use/Land Cover

Present land use and land cover in the PAPA was categorized using the USGS classification system (Anderson et al., 1976), the same system that was used in the PAPA DEIS (BLM, 1999a). In the USGS classification system, there are 13 categories of land use within 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 within 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. Likewise, most Nonforested Wetlands are associated with riparian areas or are otherwise proximate to one river or the other and are mostly on private land.

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 these 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). Most wellfield development in the PAPA has been in the Shrub and Brush Rangeland land use type. Most of the disturbance proposed by Operators for 2006 is in the Shrub and Brush Rangeland land use type.


Map 3.7-1
Existing Wellfield Disturbance
in Relation to Land Use/Land Cover 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 2005
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
N
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for use of the data for purposes not intended by the BLM

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

Land Use/Land Cover Type	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Cropland and Pasture	7,595	122.2	20.0	142.2	1.9
Forested Wetlands	1,542.32	16.6	8.6	25.2	1.6
Herbaceous Rangeland	855	13.9	0.0	13.9	1.6
Industrial	70	9.5	0.5	10.0	14.3
Mixed Rangeland	6,278	71.2	9.9	81.1	1.3
Nonforested Wetlands	8,964	102.5	9.1	111.6	1.2
Reservoirs	23	0.00	0.0	0.0	0.0
Residential	180	3.5	0.0	3.5	1.9
Sandy Areas Other than Beaches	97	6.1	0.0	6.1	6.3
Shrub and Brush Rangeland	172,005	4,328.6	332.8	4,661.4	2.7
Mines, Quarries and Gravel Pits	167	0.6	0.0	0.6	0.4
Transitional Areas	32	0.6	0.0	0.6	1.9
Transportation, Communication, Utilities	226	3.2	0.0	3.2	1.4
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

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, revising the 1978 plan. The new 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). The County Plan is summarized by the following key points:

- 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.

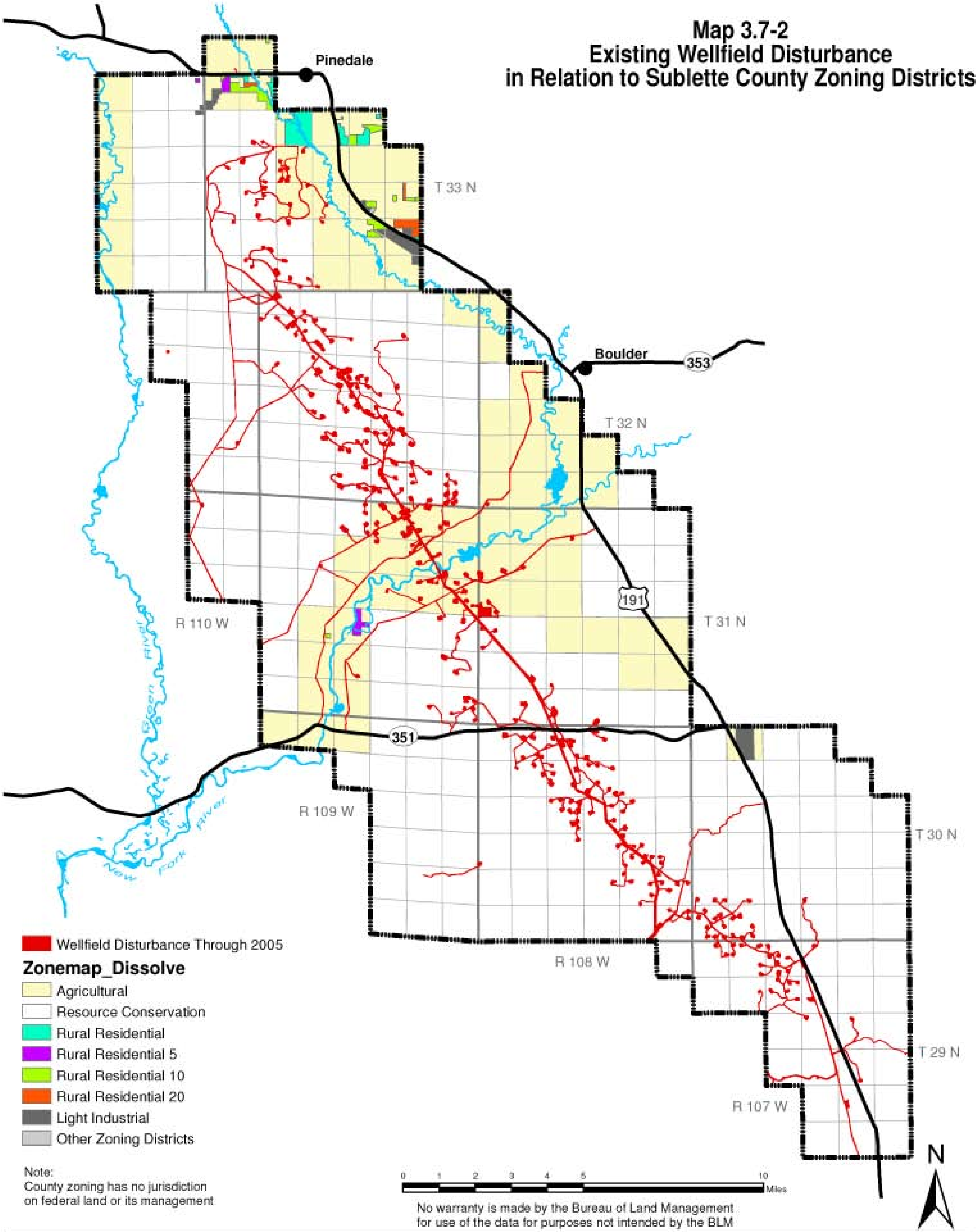
The Sublette County Zoning and Development Regulations (Sublette County, 2002) were most recently revised in 2003. The regulations aid in implementing the Sublette County Comprehensive Plan, provide for orderly and well-planned development within the County, protect the various land uses and zones from harmful encroachment by incompatible uses, and ensure that land allocated to a zoning district is not usurped by other, 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 surface area and existing wellfield disturbance within the PAPA in each zoning district. Most wellfield development is in the Resource Conservation Zoning District which protects and conserves environmentally sensitive areas where development is limited (Sublette County, 2002). As of December 2005, over 4,000 acres had been disturbed in that zoning district, which is nearly 93 percent of all wellfield development in the PAPA (Table 3.7-2). Most wellfield disturbance projected for 2006 is in the Resource Conservation Zoning District (Table 3.7-2). Most of the area designated as Resource Conservation zoning within the PAPA is on federal lands and minerals ownership.

While Sublette County has included federally administered lands within their zoning districts, normally the county has no jurisdiction on those 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
Wellfield Disturbance in Relation to Sublette County Zoning Districts

Sublette County Zoning District	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Agricultural	46,527	1,026.5	93.2	1,119.7	2.4
Highway commercial	33	0.5	0.0	0.5	1.5
Heavy industrial	37	0.0	0.0	0.0	0.0
Light Industrial	458	6.6	0.0	6.6	1.4
Rural residential	1,398	11.9	0.0	11.9	0.9
Rural residential 10	366	5.6	0.0	5.6	1.5
Rural residential 20	167	0.8	0.0	0.8	0.5
Rural residential 5	128	2.2	0.0	2.2	1.7
Rural residential mobile/manufactured home 10	34	0.0	0.0	0.0	0.0
Resource Conservation	148,870	3,624.4	287.7	3,912.1	2.6
Rural mixed	16	0.0	0.0	0.0	0.0
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**


Map 3.7-2
Existing Wellfield Disturbance
in Relation to Sublette County Zoning Districts
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 2005
Zonemap_Dissolve
Agricultural
Resource Conservation
Rural Residential
Rural Residential 5
Rural Residential 10
Rural Residential 20
Light Industrial
Other Zoning Districts
Note:
County zoning has no jurisdiction
on federal land or its management
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

3.7.1.3 Residential Areas and Subdivisions

Most land in the PAPA that is zoned by the County for residential use is concentrated in the north. These areas represent an estimated 2,093 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 138 acres within the Residential SRMZ (as defined in July 2000) have been disturbed by wellfield development through December 2005. Another 7 acres is projected to be disturbed in 2006.

3.7.2 Pipeline Corridors and Gas Sales Pipeline

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 Within the PAPA

3.8.1.1 Recreational Activities

A brochure promoting Sublette County recreation opportunities claims 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. The BLM Recreation Management Information System (RMIS) for the Pinedale Field Office Administrative Area (12.9 percent of BLM managed lands in southwestern Wyoming) estimated that there were 319,978 total recreation days (one day spent by one person recreating) per year, averaged from 1998 through 2002 and distributed among 23 recreational activities (Table 3.8-1). According to the RMIS data, the most prevalent recreation uses in the PAPA and vicinity are boating and fishing on the New Fork and Green rivers.

Map 3.7-3 Existing Wellfield Disturbance in Relation to Residential Sensitive Resource Management Zone

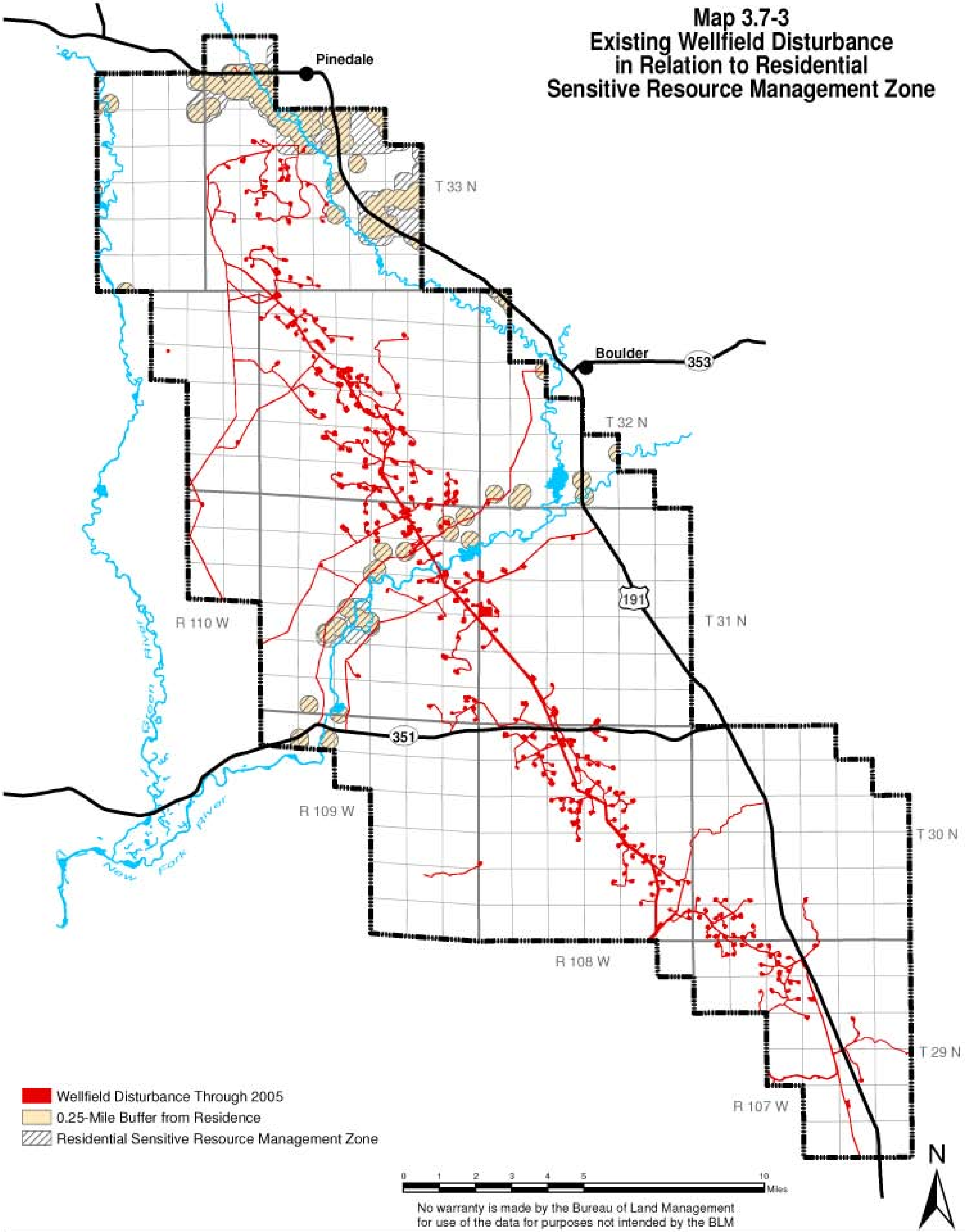


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Table 3.8-1
Recreation Use Days in the BLM Pinedale Field Office Administrative Area October 1998 through September 2002

Recreational Activity	Recreation Days Per Year
Row/float/raft-boating	138,630
Fishing	73,227
Camping	35,168
Nonmotorized travel (hiking, walking, running)	30,581
Snowmobiling	12,368
Pack trips and backpacking	6,864
Mountain biking	5,066
Driving for pleasure	4,182
Viewing wildlife	2,727
Cross country skiing	2,123
Picnicking	1,366
Off-highway vehicles (all-terrain vehicles)	1,268
Nature study	880
Photography	880
Swimming	854
Staging/comfort stop	829
Motorized boating	789
Archery	760
Horseback riding	732
Rock climbing	458
Off-highway vehicles (cars/trucks/SUVs)	155
Environmental education	55
Road bicycling	16
TOTAL	**319,978**
Source: BLM, 2003a	

Big game hunting (pronghorn antelope, elk, moose, and mule deer) is another major recreational activity in the PAPA. Hunting recreation-days is not included in the RMIS data set. 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, for example, there were 28,977 recreation-days of hunting in those 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 relatively 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 2005

Hunter Category	2000	2001	2002	2003	2004	2005[1]
Antelope Hunt Areas 87 and 90:						
Residents	1,776	1,454	1,760	1,771	1,784	1,366
Non-Residents	795	681	649	545	830	917
Total	**2,571**	**2,135**	**2,409**	**2,316**	**2,614**	**2,283**
Mule Deer Hunt Areas 138, 139, 140:						
Residents	5,810	7,380	8,819	7,137	4,943	4,683
Non-Residents	908	137	1,498	1,308	852	1,071
Total	**6,718**	**7,517**	**10,317**	**8,445**	**5,795**	**5,754**
Elk Hunt Areas 96, 97, and 98:						
Residents	13,610	14,094	15,019	12,612	11,021	9,981
Non-Residents	2,991	3,801	3,676	1,305	2,886	3,220
Total	**16,601**	**17,895**	**18,695**	**13,917**	**13,907**	**13,201**
Moose Hunt Area 4:						
Residents	253	193	237	293	126	357
Non-Residents	29	7	31	336	33	17
Total	**282**	**200**	**268**	**629**	**159**	**374**
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] Estimates from Frost, 2006; Clause, 2006a, 2006b, and 2006c.
Sources: WGFD 2002a, 2003a, 2004a, 2005a and 2006a; BLM, 1988b; and DOI et. al., 2003.

As the human population grows in Sublette County (see Section 3.5, Table 3.5-6), the need for dispersed recreation is expected to increase in the PAPA. The U.S. Fish and Wildlife Service (FWS) collects state-level data on fishing, hunting, and wildlife-viewing every 5 years. The most recent surveys, in 1996 and 2001, were used to estimate the rate of change in recreation demand for Wyoming (Table 3.8-3). Hunting and wildlife viewing decreased while fishing increased.

Table 3.8-3
Recreation-Days Spent Fishing, Hunting,
and Viewing Wildlife in Wyoming During 1996 and 2001

Recreation Activity	1996	2001	Percent Change 1996-2001
Total Days of Fishing	3,827,000	4,398,000	14.9
Total Days of Hunting	2,398,000	2,174,000	-9.3
Total Days of Wildlife Viewing (non-residents only)	669,000	511,000	-23.6

Source: FWS, 1998 and 2003c.

Recreation demand in Sublette County is hypothesized to follow patterns observed for Wyoming. Based on that assumption, Table 3.8-4 provides an estimate of change in recreation days from 2001 to 2006. While recreation days spent fishing are likely to increase, time spent viewing wildlife and hunting is expected to decrease in the County.

Table 3.8-4
Estimated Recreation-Days for Activities in Sublette County During 2001 and 2006

Year	Fishing	Wildlife Viewing	Hunting	Other [1]	Total
2001	73,227	2,727	28,977	244,024	348,955
2006	78,280	2,362	27,557	244,024	352,223[2]

[1] Includes recreation-days spent other than fishing, wildlife viewing, and hunting
[2] Total in 2006 assumes that recreation-days for "Other" activities remained the same as in 2001.
Sources: BLM, 2003a; FWS, 1998 and 2003c.

3.8.1.2 Recreation Sites and Facilities

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 through the PAPA 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).

There is a large area in the north end of the PAPA, near Mount Airy, which was identified by BLM as a possible Off-Highway Vehicle (OHV) use area prior to 1999. An OHV plan was not developed for the Mount Airy site, and there has been no progress in its designation. The Pinedale RMP (BLM, 1988a) restricted travel on the Mesa during the winter to protect mule deer and antelope on winter ranges. Other travel was 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).

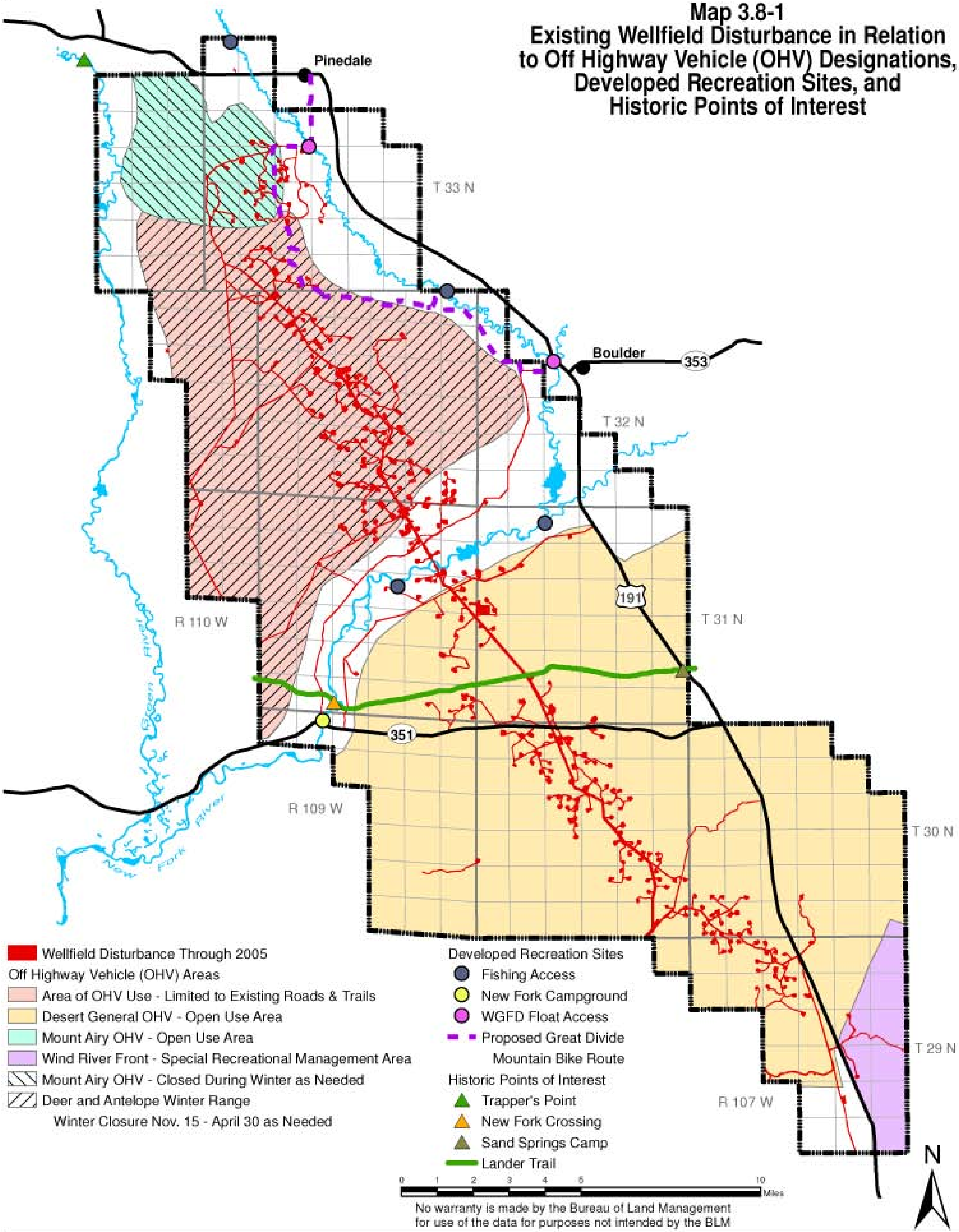
A portion (5,141 acres) of the southeastern part of the PAPA coincides with the Wind River Front Special Recreation Management Area (SRMA) which is managed by BLM's Rock Springs Field Office. The portion of the SRMA in the PAPA has been managed for dispersed recreation (camping, hunting, and fishing),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

As of December 2005, there were approximately 27 acres of wellfield disturbance within the Wind River Front SRMA that coincides with the PAPA (Table 3.8-5). Most development has been in the Desert General OHV Open Use Area, south of the New Fork River. By December of 2005, there were over 2,200 acres of wellfield disturbance in the Desert General OHV Open Use Area, with an approximate disturbance of more than 3,900 acres in all public recreation areas. An additional 318.3 acres of wellfield disturbance is projected for 2006 in all public recreation areas (Table 3.8-5).

Table 3.8-5
Estimated Existing Wellfield Disturbance in Relation to Public Recreation and OHV-Designated Areas in the PAPA

Recreation Area	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Mount Airy OHV Area	9,202	178.6	17.2	195.8	2.1
OHV Areas Limited to Existing Roads, Trails	48,036	1,463.1	149.2	1,612.3	3.4
Desert General OHV Open Use Area	9,0361	2,238.9	151.9	2,390.8	2.6
Wind River Front Special Recreation Management Area	5,141	26.6	0.0	26.6	0.5
Total	**152,740**	**3,907.2**	**318.3**	**4,225.5**	**2.8**

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



Both the New Fork and Green rivers flow through the PAPA. The WGFD's Basin Management Plans (WGFD, 2006b) 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 Snake River cutthroat trout. On the East Fork River to Pine Creek, anglers find brown trout and rainbow trout and on the Pine Creek to New Fork Lake, 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.

3.8.2 Pipeline Corridors and Gas Sales Pipeline

BLM and Bureau of Reclamation (BOR) 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 hang gliding (Sweetwater 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 antelope, 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, 2002). 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, 2002).

Each of the three proposed corridors and pipeline alignments cross the Little Colorado Wild Horse Herd Management Area (HMA), managed by BLM's Rock Springs Field Office. 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, 2002).

3.9 VISUAL RESOURCES

3.9.1 Development Within the PAPA

BLM manages visual resources in several Visual Resource Management (VRM) classes within the Pinedale Field Office Administrative Area. The PAPA contains three VRM classes; Class II, Class III, and Class IV. The management objectives for each VRM class were described in the PAPA DEIS (BLM, 1999a) and are 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.

The most extensive natural gas development in the PAPA has been within VRM Class IV, which incorporates approximately 126,510 acres or about 64 percent of the PAPA (see Map 3.9-1). As of December 2005, more than 3,000 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 are a minor portion of federally managed lands and minerals in the PAPA. Those areas are located primarily along the river flood plains on private lands. Consistent with the past, most new disturbance projected in 2006 is within VRM Class IV areas (Table 3.9-1).

Table 3.9-1
Estimated Existing Wellfield Disturbance in Relation to Visual Resource Management Classifications in the PAPA

VRM Classes	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
VRM II	22,013	333.0	21.8	354.8	1.6
VRM III	49,511	1,024.5	69.2	1,093.7	2.2
VRM IV	126,510	3,321.0	289.9	3,610.9	2.9
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

The PAPA DEIS (BLM, 1999a) established a Sensitive Viewshed SRMZ to address public concerns regarding the visual sensitivity of the portion of the PAPA that is visible from Pinedale and U.S. Highway 191 leading into town. The Sensitive Viewshed was modeled to include areas visible from the six viewpoints shown on Map 3.9-2. MA 4 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.

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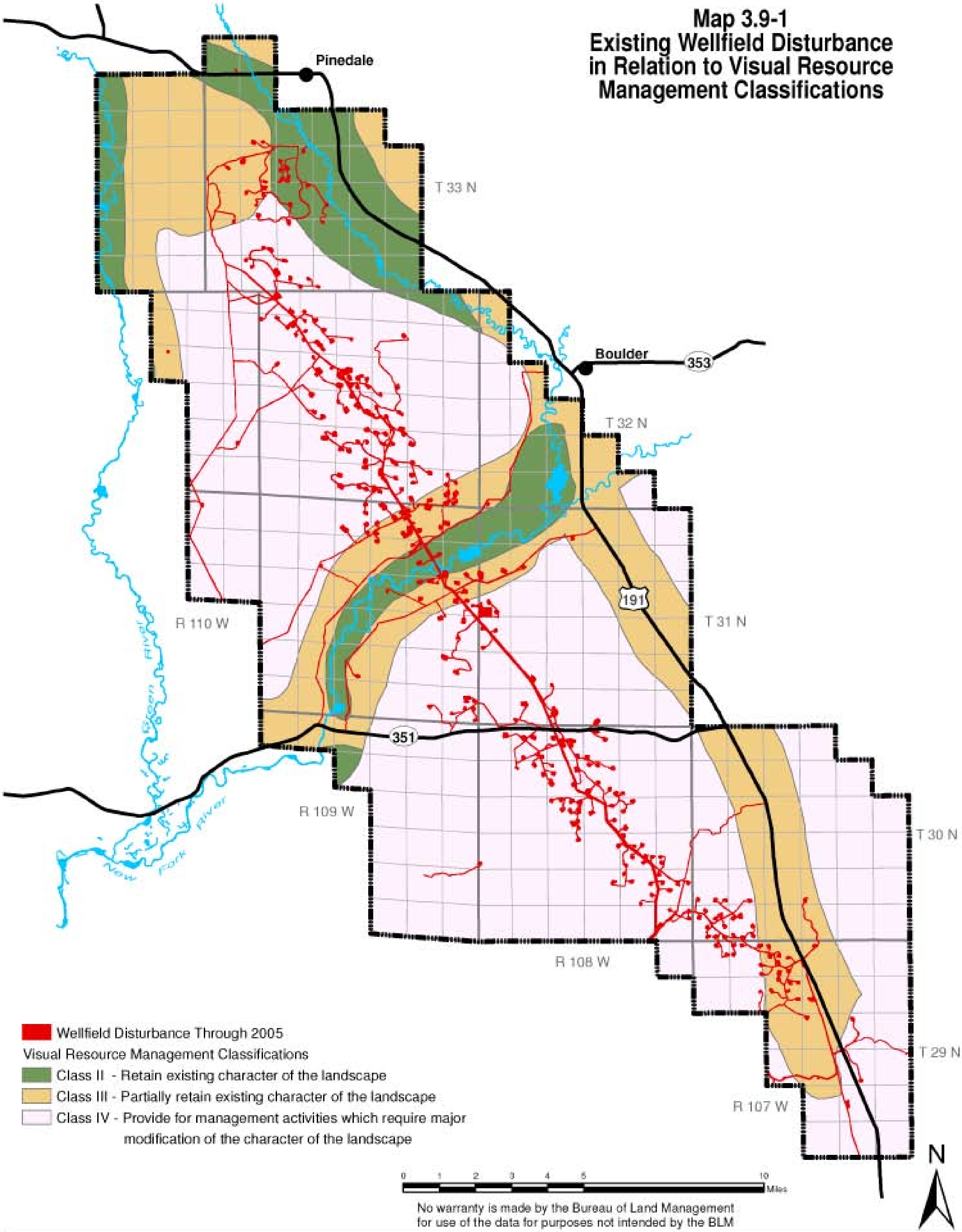
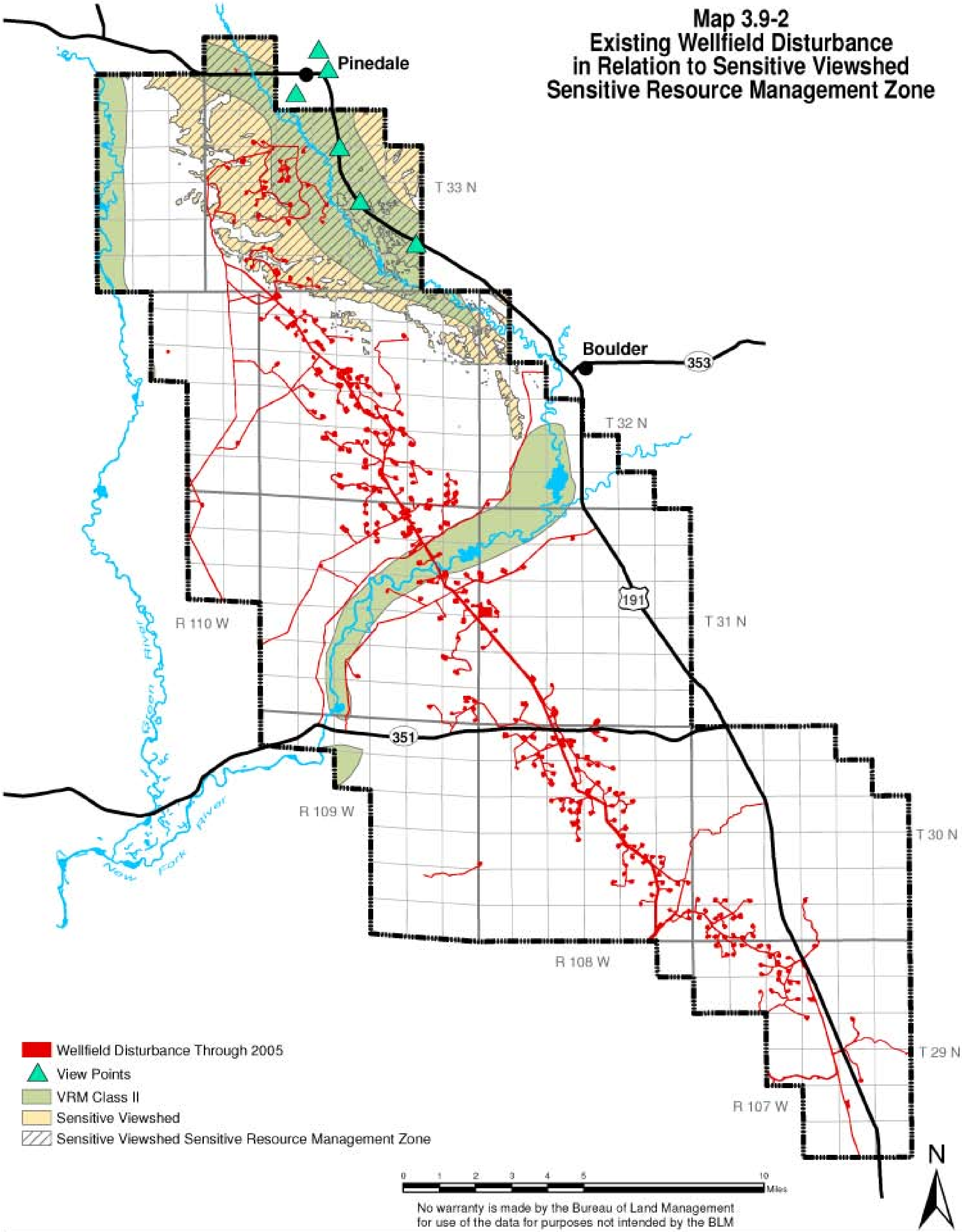

Map 3.9-1
Existing Wellfield Disturbance in Relation to Visual Resource Management Classifications
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Visual Resource Management Classifications
Class 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 2005
View Points
VRM Class II
Sensitive Viewshed
Sensitive Viewshed 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

The major portion of the Sensitive Viewshed SRMZ is classified as VRM Class II and VRM Class III and is located in the northern portion of the PAPA (Map 3.9-2). The Sensitive Viewshed SRMZ covers 21,526 acres in the PAPA. As of December 2005, there were approximately 390.4 acres of wellfield disturbance in the Sensitive Viewshed SRMZ. The Operators have proposed an additional disturbance of 15.8 acres in that area in 2006. In all, 406.2 acres of the Sensitive Viewshed SRMZ (1.9 percent of the total viewshed area) will have been disturbed at the end of 2006.

3.9.2 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-ways 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 New Fork and Green 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 Within the PAPA

The BLM manages cultural resources on public lands in accordance with the Antiquities Act of 1906, National Historic Preservation Act of 1966, Native American Graves Protection and Repatriation Act, the Archaeological Resources Protection Act of 1979, and various other codes and Executive Orders. The management process is governed by the requirements of the State Protocol Agreement, recently revised in 2006, between the BLM and the Wyoming State Historic Preservation Office (SHPO) (see Appendix G). 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. Within the PAPA, site types include (but are not limited to) prehistoric campsites, house pits, human burial sites, lithic procurement sites, rock alignment sites (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).

The Trappers Point area north of the PAPA is known for its rich archeological sites. Terraces of the New Fork River and the Blue Rim Area carry significant potential. Rock alignment sites are concentrated around the edges of the Mesa (Crume, 2006). Trappers Point is a crucial stock sorting area for “The Drift”, a century-old seasonal stock driveway considered part of a potential Sublette County Rural Ranching Traditional Cultural Property and potentially, a Rural Historic Landscape. Other historical resources in the PAPA include pioneer settlements such as the New Fork Townsite, listed on the National Register of Historic Places (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 gas development has occurred.

Within 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). However, 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. That 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 NRHP were documented along the Anticline Crest and later subjected to pipeline construction. Those sites have been the subject of several 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 Pinedale 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 during 2006, expansion of a well pad yielded archeological discoveries as well as a unique rock alignment that required a specific management strategy.

During 2006, a Folsom projectile point estimated to be 11,500 years old was discovered at a proposed well pad site in the southern end of the PAPA. Folsom sites are among the oldest prehistoric occupations known in North America. Construction of the proposed pad was cancelled. 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). 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 within the PAPA. There is a high potential for the discovery of sacred sites and sites of interest to modern Native Americans. Sites most likely to be discovered will probably be related to prehistoric and historic Native American hunting and seasonal activities. 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 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 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 the guideline as presented above proves not to be workable, individual consultation will be needed (Ferris, 2004).

Approximately 527 sites (Vlcek, 2006) had been inventoried on over 5,320 acres within the PAPA prior to December 2005, and many additional sites have been inventoried since then. Class III inventories were used during these 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 surface 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

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

3.10.1.3 Major Finds

During the first 5 years of wellfield development in the PAPA, one especially sensitive archeological zone was revealed in the sandy bluffs on the north side overlooking the New Fork River. Several discoveries in that 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 antelope kill site has been excavated, a period coinciding with large game exploitation along the New Fork River.

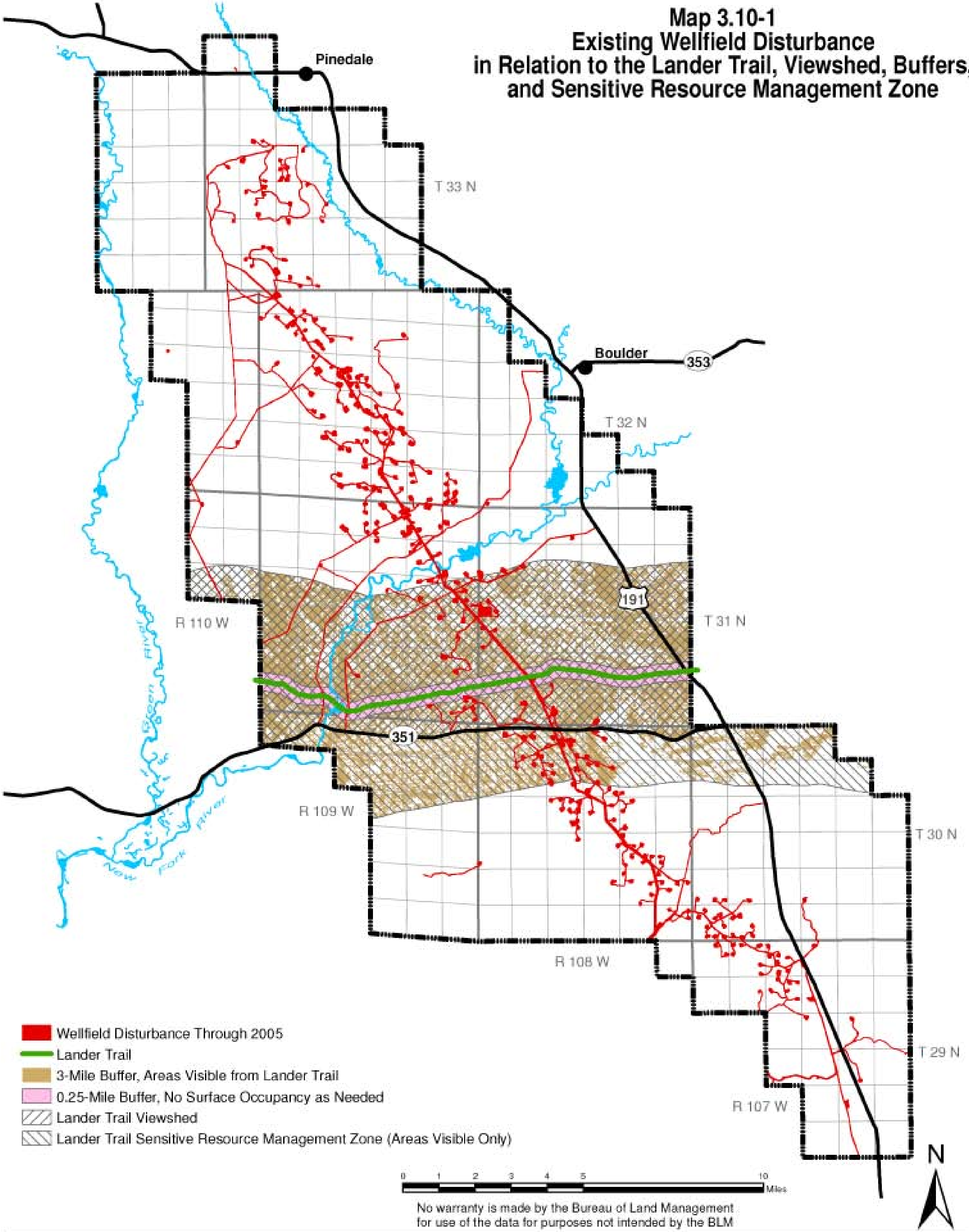
3.10.1.4 Lander Trail SRMZ

The Oregon Trail system, in which the Lander Trail Cut-off is included, is listed on the NRHP. The PAPA ROD (BLM, 2000b) established a 0.25-mile buffer from the Lander Trail within which BLM could prohibit construction activities on federally administered lands unless topography blocked visibility of a site (Map 3.10-1). That condition was consistent with the Pinedale RMP (BLM, 1988b) which authorized that no surface disturbance would be allowed within one-quarter 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).

Table 3.10-1
Estimated Existing Wellfield Disturbance in Relation to the Lander Trail SMRZ and Viewshed

Lander Trail SRMZ Category	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Lander Trail 0.25-mile Buffer	3,978	60.5	6.8	67.3	1.7
Lander Trail SRMZ (PAPA DEIS)	22,893	480.1	52.7	532.8	2.3
Lander Trail Viewshed (PAPA ROD)	18,105	351.9	36.2	388.1	2.1

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



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

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 the 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 which identified ten Key Observation Points (KOPs) along 8 miles of the trail. In 2005, BLM and SHPO signed 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 concealing wellfield developments (Vlcek, 2006 and Trautman, 2006).

As of December 2005, approximately 480 acres had been disturbed within the entire Lander Trail SRMZ (defined in the PAPA DEIS) of which approximately 61 acres were within the 0.25-mile buffer of the Lander Trail (Table 3.10-1). That disturbance includes well pads, roads (upgrading three collector roads: the Paradise Road, Boulder South Road, and Middle Crest Road), and pipelines. In 2005, 352 acres had been disturbed by wellfield development within the Lander Trail Viewshed (defined in the PAPA ROD) with another 36 acres of disturbance projected for 2006 (Table 3.10-1). 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 100 feet from the trail, significantly impacting 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 BLM, the Wyoming SHPO, the Advisory Council on Historic Preservation, Shell, and Ultra, to maintain the integrity of the trail (see Appendix H). 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 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 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 (see Appendix G), a document that describes how the Wyoming SHPO and BLM will consult on cultural resource management (though not specific to the PAPA), was sufficient enough to protect resources in the PAPA. The Task Group determined that the Wyoming Protocol streamlines archeological resource management, and that a new PA would be unnecessary.

Because there are several Operators in the PAPA, obtaining consensus on the extremely varied cultural resource management has proven difficult (Vlcek, 2006). Further, the different geographic settings within the PAPA contain significantly different types of cultural resources.

For example, the northern end of the Mesa and sensitive soils identified in the PAPA DEIS (BLM, 1999a) in the Mesa Breaks contain numerous Native American sites. Cultural resources discovered near the New Fork River have been discussed, above. Leaseholds within the Blue Rim Area have encountered conflicts over specific archeology and paleontological materials found there (see Paleontological Resources, below). The south end of the PAPA is an area of complex archeological discoveries such as the New Fork Wagon Road (NRHP eligible).

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 time periods. The prehistoric period extends from approximately 12,000 years before present (B.P.) through 350 B.P., 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 corridors/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. 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 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 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, Cheyenne, 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 southwestern Wyoming and surrounding areas. The discussion below is for proposed development within the PAPA and for the proposed construction of the natural gas pipelines.

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.

Greenhouse gases (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, Wyoming Department of Environmental Quality–Air Quality Division (WDEQ-AQD) does not have regulations regarding greenhouse gas emissions, although these emissions are regulated indirectly by various other regulations for other pollutants.

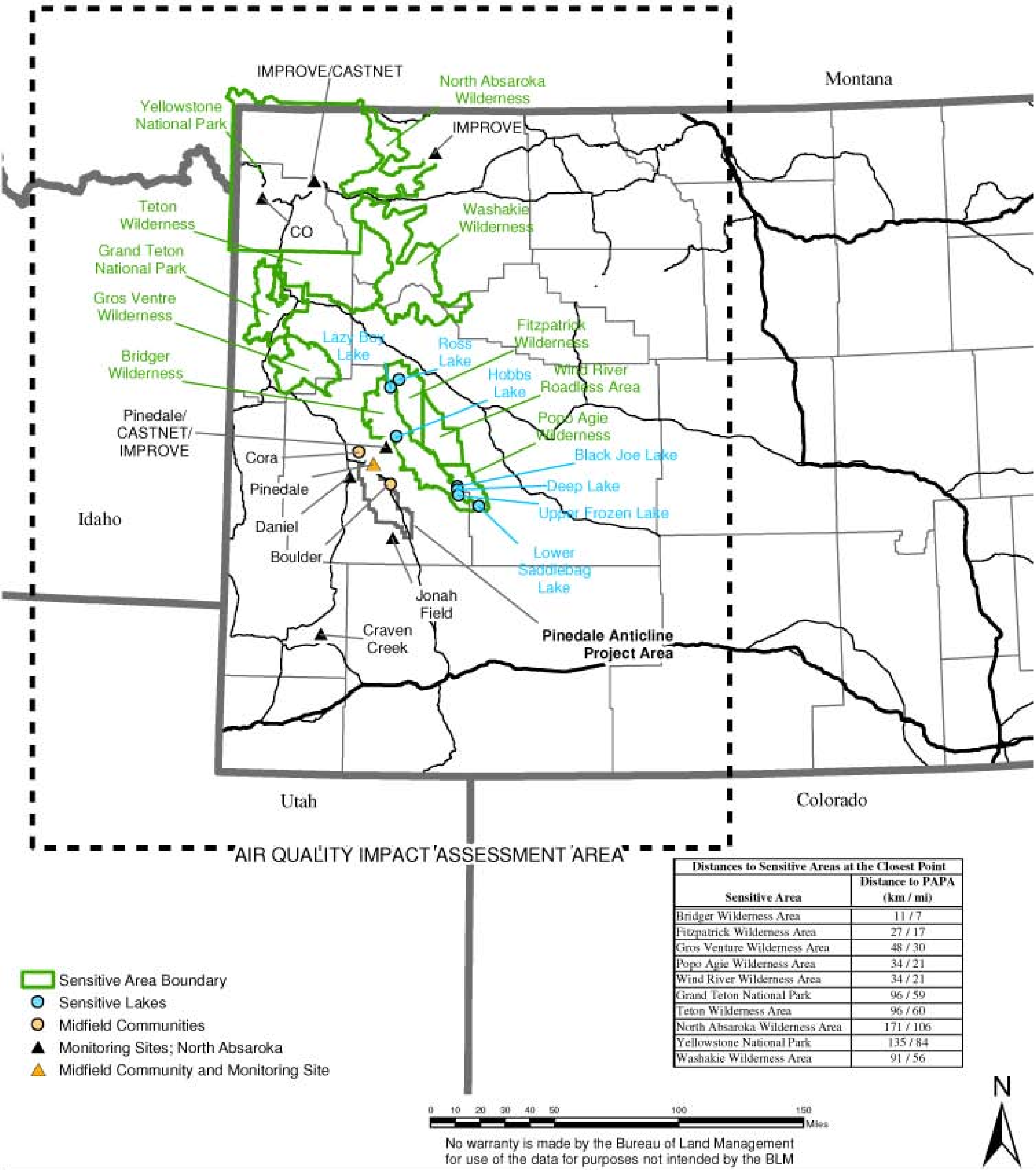
Regional pollutants of concern have been monitored at several sites within Sublette County adjacent to the PAPA. The locations are within the Jonah Field, at the eastern edge of the PAPA near Boulder, and northwest of Pinedale near Daniel. The Boulder site has been in operation since September 2004, 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 here 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 Boulder site.

Table 3.11-1
Air Pollutant Background Concentrations and
Wyoming and National Ambient Air Quality Standards (ug/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 8 6	100
Ozone (O_3)	Jonah Field [2] Boulder [3] Daniel [4]	8-hour [5]	149 157 145	157[6]
Particulate matter (PM_{10})	Jonah Field [2] Boulder [3] Daniel [4]	24-hour [7]	51 32 23	150
	Jonah Field [2] Boulder [3] Daniel [4]	Annual	10 9 9	50
Particulate matter ($PM_{2.5}$) [7]	Pinedale [8]	24-hour [7]	15	65 (35)[9]
		Annual	6	15
Sulfur dioxide (SO_2) [8]	Craven Creek [10]	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."
[2] Background data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005.
[3] Background data collected approximately 5 miles southwest of Boulder, Sublette County, Wyoming. Values are based on one year of data collected during (April 2005 through March 2006).
[4] Background data collected approximately 5 miles south of Daniel, Sublette County, Wyoming off Hwy. 18. Values are based on 1 year of data collected during July 2005 through June 2006.
[5] Highest, fourth highest monitored value.
[6] 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.
[7] Highest, 98^{th} percentile monitored value.
[8] Background data collected in Pinedale, Wyoming. Values are based on 1 year of data collected during July 2005 through June 2006.
[9] Proposed new National Ambient Air Quality Standard. 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.
[10] Background data collected at the LaBarge Study Area/Northwest Pipeline Craven Creek site in 1982-1983.

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

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 upon 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 in Map 3.11-1 as sensitive areas. The PSD Class I and Class II Increments are provided in Table 3.11-2.

Table 3.11-2
Prevention of Significant Deterioration (PSD) Increments (ug/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

The 1977 Clean Air Act amendments established visibility as an Air Quality Related Value (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 more diffuse emission sources become well mixed 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 just 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 and atmospheric deposition are 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 Bridger Wilderness Area, North Absaroka Wilderness Area, and Yellowstone National Park IMPROVE sites are the closest such sites to the PAPA. 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 (20^{th} percentile best visibility days); for 20^{th} percentile middle conditions; and for the haziest days (20^{th} percentile haziest visibility days), respectively (IMPROVE, 2006). SVRs were reconstructed from monitored aerosol (suspended liquid or solid particles) data.

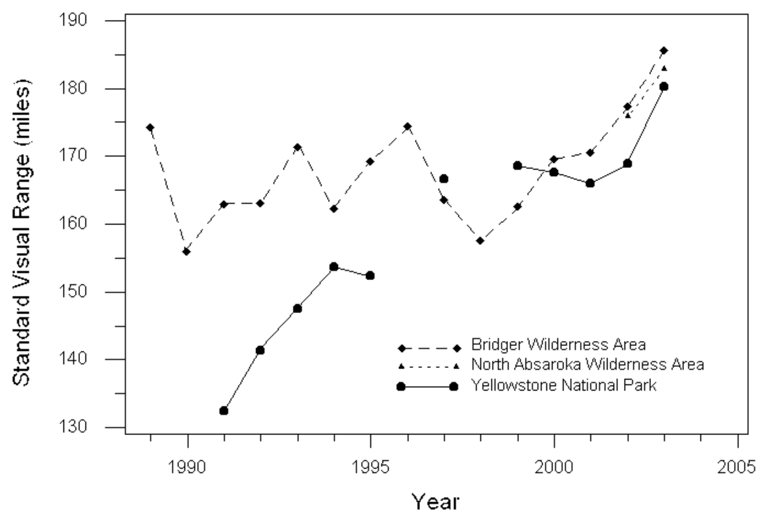


Figure 3.11-1
Standard Visual Range (SVR) for 20^{th} % Cleanest Days, Pinedale Anticline Project Area, Sublette County, Wyoming (IMPROVE, 2006)

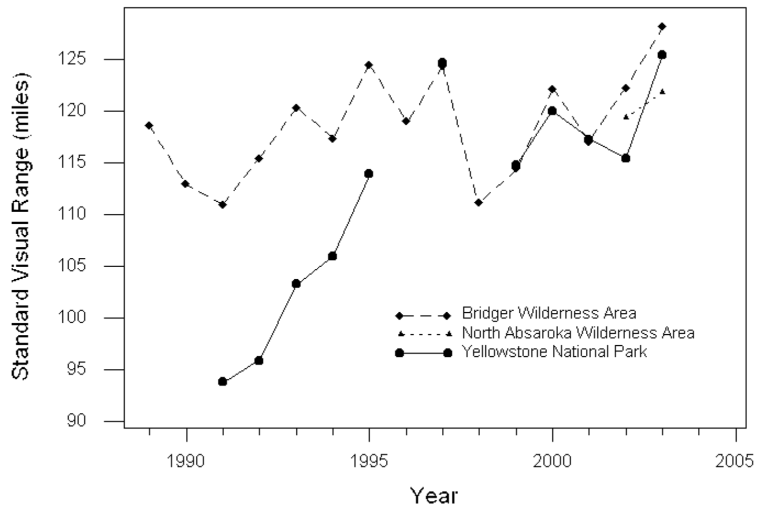


Figure 3.11-2
Standard Visual Range (SVR) for 20th % Middle Days, Pinedale Anticline Project Area, Sublette County, Wyoming (IMPROVE), 2006

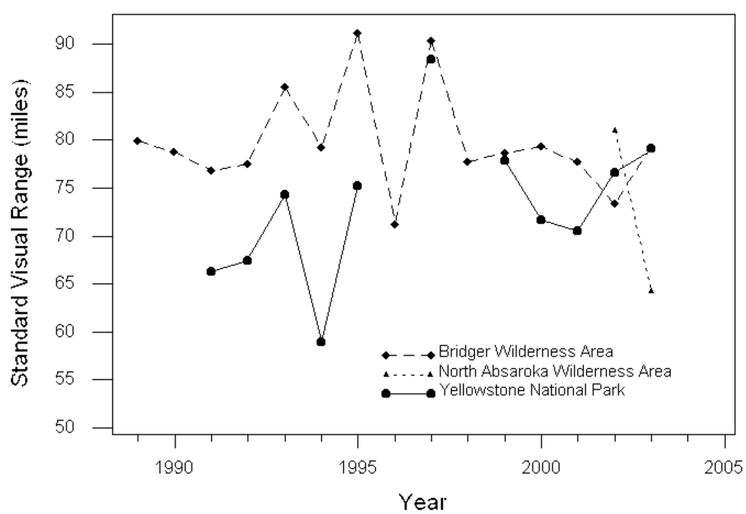


Figure 3.11-3
Standard Visual Range (SVR) for 20th % Haziest Days, Pinedale Anticline Project Area, Sublette County, Wyoming (IMPROVE, 2006)

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 (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 (NO_3), and ammonium (NH_4), and 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 also provide the contributions 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 FLAG guidelines indicates total loadings above these values, it may be suggested 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 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. For comparison with reported values from the Pinedale stations, the Bridger Wilderness LOCs are shown on Figures 3.11-4 and 3.11-5.

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

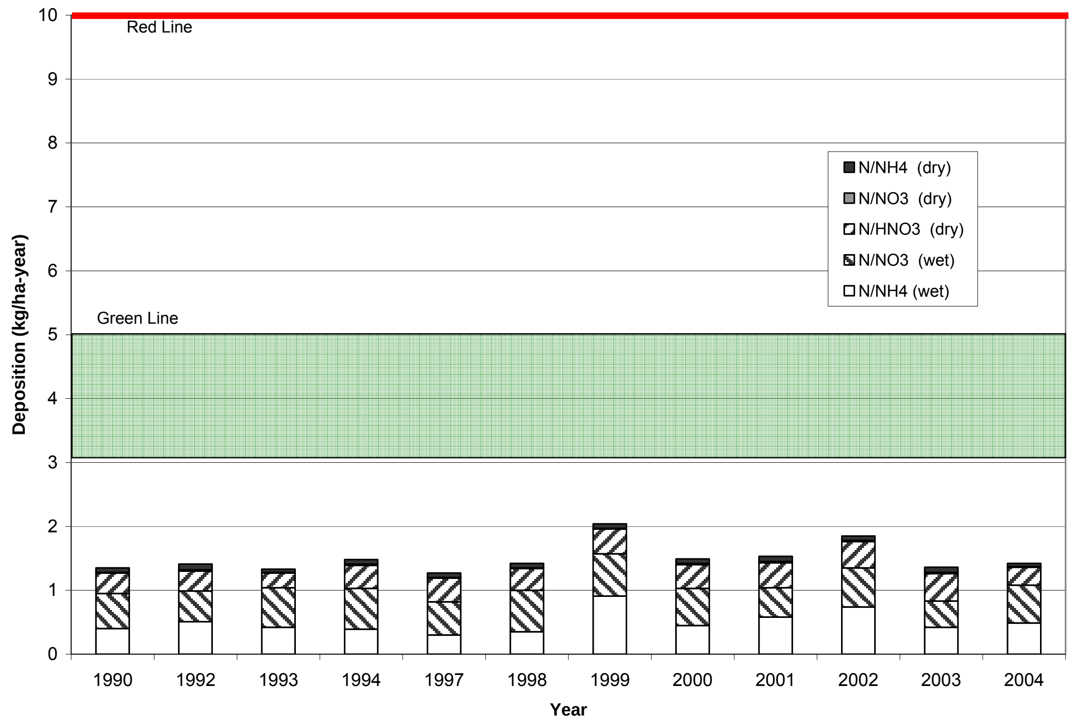


Figure 3.11-5
Mean Annual Total Nitrogen Deposition near Pinedale, Wyoming

Site-specific lake chemistry background data (pH, acid neutralizing capacity - ANC, elemental concentrations, etc.) have been collected by the USFS in several high mountain lakes in the nearby Wilderness Areas. 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 sensitive lakes within the modeling domain are provided in Table 3.11-3.

Table 3.11-3
Monitored Background Conditions at 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 are considered extremely sensitive. 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. A limit of 10 percent change in ANC reduction was adopted 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 within the PAPA were previously analyzed in the PAPA DEIS (BLM, 1999a). Since issuance of the PAPA ROD (BLM, 2000b) in July 2000, natural gas development within the PAPA has occurred at a pace greater than was analyzed in the PAPA DEIS. The PAPA ROD authorized the development of 700 producing wells or well pads (see 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 within 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 to 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 actual 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. Criteria pollutant emissions include NO_x, CO, SO_2, 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 3.11-4. Although emissions have been quantified for all criteria pollutant and HAPs, the year 2005 modeling analysis of actual 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 actual emission inventory and the air quality impact analyses are provided in the Air Quality Impact Analysis Technical Support Document (Air Quality TSD).

Table 3.11-4
Pinedale Anticline Project Pollutant Emissions for Year 2005

Pollutant	Summer (lb/hour)	Winter (lb/hour)	Total (tons/year)
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 actual emissions estimates 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 at designated acid sensitive lakes within 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 actual 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, and USFS three separate methods were performed using two different representations of background visibility conditions. Two additional visibility methods which 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 Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Report for each Class I area to represent natural background visibility. The WDEQ method uses representative monitoring data, for the quarterly average of the 20 percent best visibility days, collected from the IMPROVE network for the time period (2000 to 2004) which coincides with the time period that will be used to establish "baseline conditions" under the EPA Regional Haze Rule (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 within 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 to compare to total deposition LOC. The predicted nitrogen and sulfur deposition values at acid sensitive lakes were used to estimate change in ANC to compare to LAC.

Table 3.11-5 presents a summary of maximum predicted impacts to air quality from the 2005 wellfield development in the PAPA. The modeled impact values are provided in Appendix I Tables I.1 through I.13. The results summary shown in Table 3.11-5 and the predicted impacts provided in Appendix I represent maximum CALPUFF modeled impacts that were predicted using 3 years (2001-2003) of CALMET meteorological data.

Table 3.11-5
Summary of 2005 Air Quality Impacts from Wellfield Activities in the PAPA

Air Quality Impact	Predicted Impact Summary
Increased concentrations of NO_2, SO_2, PM_{10} and $PM_{2.5}$	Predicted concentrations are in compliance with applicable National Ambient Air Quality Standards and Wyoming Ambient Air Quality Standards 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]
Increased 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
Increased 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
Increased atmospheric/terrestrial deposition	Predicted Impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas
Increased sensitive lake ANC	Predicted impacts are less than the LAC at all acid sensitive lakes

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 that 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 new wellfield developments, 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 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 is impossible to separate noise generated by drilling from noise generated by other sources.

The noise monitoring station locations, while 35 feet from the edge of each well pad, were farther than that from the actual noise sources. The distance from drilling rig engines, which produced the most consistent noise, to noise monitoring stations varied from 184 feet to 811 feet (Table 3.12-1).

Table 3.12-1
Noise Measurements (dBA) at Three of ASU's 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 [2]	Average Noise (dBA)	Distance to nearest Engine [2]	Average Noise (dBA)	Distance to nearest Engine [2]	Average Noise (dBA)	Distance to nearest Engines [2]
Ultra Mesa 7-34	57.2	346 feet	62.9	237 feet	58.4	184 feet	54.7	811 feet
Ultra Mesa 9C-35D [3]	62.2	337 feet	69.9	255 feet	65.8	262 feet	64.4	255 feet
Shell Mesa 7-29	55.4	340 feet	58.5	356 feet	53.7	364 feet	55.2	308 feet

[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 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 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 (dwellings, greater sage-grouse leks) defined in the PAPA ROD 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, 2006a). Flaring (one component of completion operations) tended to be the loudest noise event. But, with the use of flowback separators, noise from completion operations was reduced 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, 2006a).

3.13 GEOLOGY AND GEOLOGIC HAZARDS

3.13.1 Development Within the PAPA

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 times, and with river and lake deposits during Tertiary time. 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 the 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. The underlying Fort Union Formation also 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 significant 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," have not been commercially producible until recent advances in drilling technology and enhancements, such as hydrofracturing, which opens up communication between the wellbore and the targeted sandstone.

Geologic hazards are not of notable concern in the PAPA. Steep slopes on 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 et al., 1995).

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.

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 BLM's Reservoir Management Group 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."

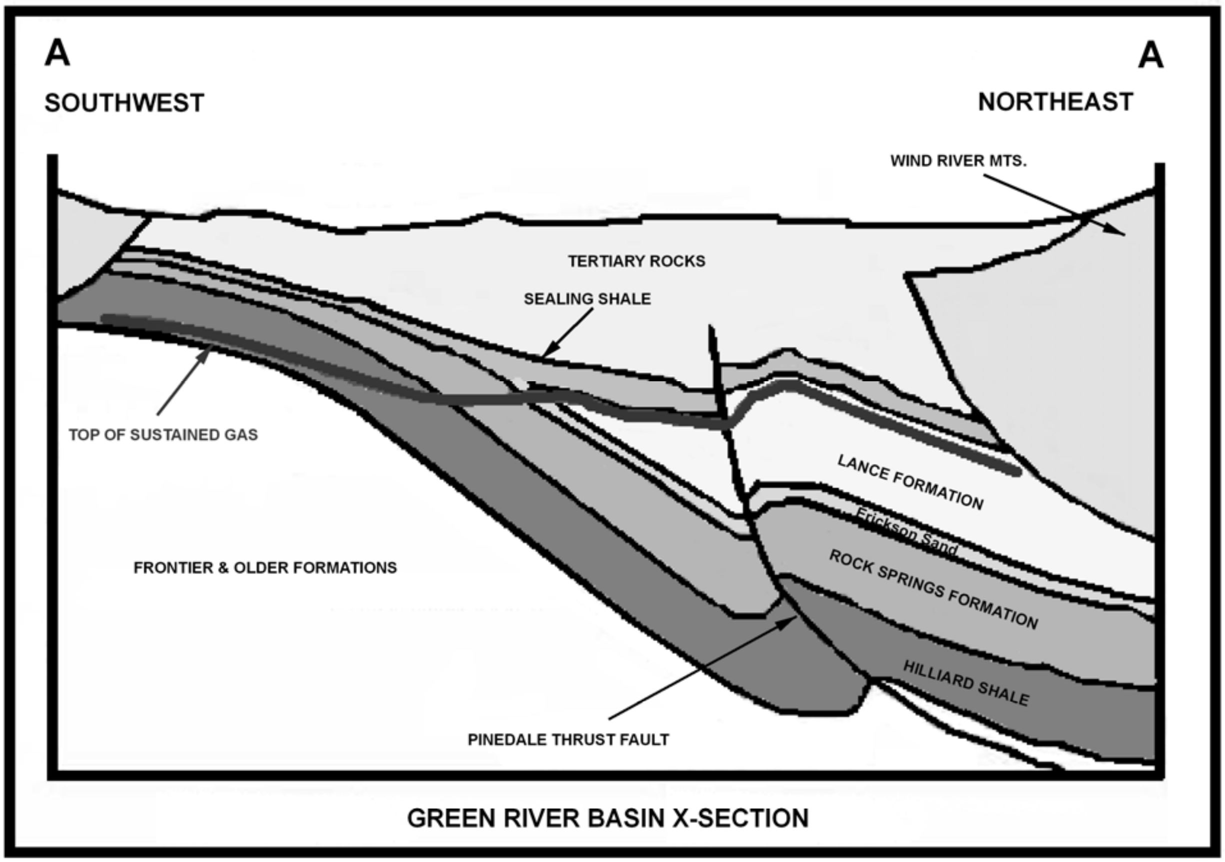


Figure 3.13-1
Geological Cross Section of the Green River Basin and Pinedale Anticline Area

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, 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, 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.

The Laney member dominates the surface geology from just south of the Blue Rim Area to just south of the Green River and underlies the initial portion of the BFGC and R6 Pipeline (Segment 2) alignments. Bluffs of exposed rocks of the Green River Formation surround Fontenelle Reservoir.

Most of the area south of the Green River traversed by the proposed BFGC and R6 Pipeline (Segment 2) alignments and the OPC and Opal Loop III Pipeline alignments is dominated on the surface by the Eocene Bridger Formation (BLM, 1999b). The Bridger is composed 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. Fractured sandstone bedrock can be found approximately 24 to 36 inches below the surface. The windblown sand deposits have been stabilized by vegetation.

Along segments of the proposed corridor/pipeline alignments that cross river bottoms, stream terraces, and on buttes, rocks of the Wasatch, Green River and Bridger formations are overlain by younger unconsolidated sediments of Quaternary age. The 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 Within the PAPA

Paleontologic resources include the remains or traces of any prehistoric organism which has been preserved by natural processes in the earth's crust. 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 BLM's Regional Paleontologist, serves as a guide for classification of potential paleontological resources (BLM, 2003c). The PFYC is a draft 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) resulted in identification of 59 fossil localities of importance near the PAPA. An additional 15 localities of importance were identified in a published report on the geology and paleontology of the area (West, 1973).

The Green River and Wasatch formations continue to have high potential for yielding significant paleontological resources within the PAPA. Fossils can be found where formation outcrops exist, and when surface disturbance exposes the formations. In general, the more accessible an area is, 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). An objective of this MA is to protect the paleontological resources and avoid disturbing the outcrops of the Wasatch. As of December 2005, there were approximately 525 acres of wellfield disturbance within the Blue Rim Area with an estimated disturbance of 65 acres projected in 2006. Several vertebrate fossils, including turtles, crocodilians, and fish, were recorded at paleontological localities found in the Blue Rim Area (Drucker, 2006). Most recently, a fossil mammal, possibly that of an early rodent, was found during road construction 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, and 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, exposed intermittently along the proposed corridor/pipeline alignments, are known to produce scientifically significant fossils, have the highest paleontological potential and meet the BLM's standards for Paleontology Condition 1 and Probable Fossil Yield Classification 4 and 5 (Hanson, 2006b).

Overlying these formations along portions of corridors crossing river bottoms and some uplands is a varying thickness of Quaternary (Recent) age sediments that are, for the most part, too young to contain fossils. However, one locality in Quaternary sediments along Yellowpoint 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 just 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 a geologist, 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. (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 apparently 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 has been documented along the proposed corridor/pipeline alignments in previous project reports (EVG, 1999, 2001a, 2001b, 2002a, 2002b). Fossil turtles and other reptiles are the most common vertebrate fossil in the Bridger Formation. Most specimens are fragmentary, but 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 on several occasions since 1998 (EVG, 1999, 2001a, 2001b, 2002a, and 2002b). Monitoring has confirmed the presence of vertebrate fossils in the surface lithology along existing pipeline rights-of-way.

3.15 GROUNDWATER RESOURCES

3.15.1 Development Within 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. Drilling water supply is drawn from the Wasatch Formation, in wells from 200 to 1,000 feet deep. Water is not used from the underlying Fort Union aquifer because it is deep and of low quality. The gas target zone is the much deeper Lance Formation, which yields low quality water (produced water) in the gas stream.

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 then cut through by the New Fork River. On the Mesa, it is up to 150 feet thick. 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 which constitutes 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. 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 and is not well characterized (Glover et al., 1998).

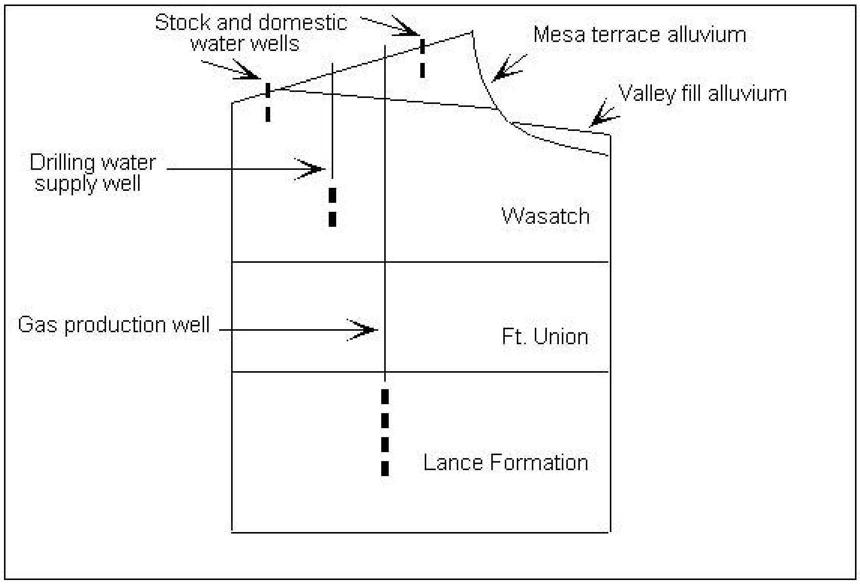


Figure 3.15-1
Relationship Between Major Formations and Aquifers

3.15.1.2 Recharge

Regional potentiometric maps (Glover et al., 1998) for the Wasatch 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 and discharge to surface water directly or through valley fill alluvium in local drainages.

Annual precipitation is approximately 20 inches in the Wyoming Range (USGS, 1985), and up to 30 inches in the Wind River Range, where the Wasatch is apparently recharged. Because the Wasatch does not crop out against the Wind River Range, infiltration is likely to be less than 1 inch per year in this primary recharge area. Hamerlinck and Arneson (1998) indicate average infiltration rates (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.

Probably less than half the recharge in the PAPA is to groundwater which is used for stock and domestic supply. Most of the rest of the recharge discharges from alluvium to surface water. A small fraction of the recharge passes through the alluvium into the Wasatch aquifer. The Wasatch in turn appears, from potentiometric data, to discharge some groundwater to the New Fork River in the reach crossing the anticline. The smaller streams south of the New Fork River do not show this connection between surface water and groundwater.

3.15.1.3 Groundwater Quality

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

The Wasatch contains many discontinuous sands with variable water quality, but here it is treated as one unit because it is treated as one unit for water supply. This complicates discussion of its quality and flow patterns. Wasatch 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 because the Wasatch sands are discontinuous and wells are completed in different intervals, there is no evident geographic trend in TDS or any ionic constituent.

Sulfate and TDS data from Wasatch 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 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 water supply wells that were sampled. However, others (Chafin and Kimball, 1992) showed regional pH in the Wasatch commonly between 8.5 and 9.5. Wasatch water quality ranges from Class I (drinking water) to Class III (stock water) (WDEQ, 2005a). Any Wasatch water is suitable for drilling, but some with higher salinity may not be appropriate for cementing.

Fort Union 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.

PAPA valley fill alluvium groundwater is a mix of surface water, Wasatch water, and alluvial water, and the water quality reflects 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 further in Appendix C and in Section 3.16 - Surface Water.

3.15.1.4 Groundwater Quantity

Historically, groundwater development within 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 supply water for drilling, in the quantity of approximately 15,000 bbl per gas well. Most of this drilling water has been obtained from water supply wells installed in the Wasatch 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 (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 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 compiled.

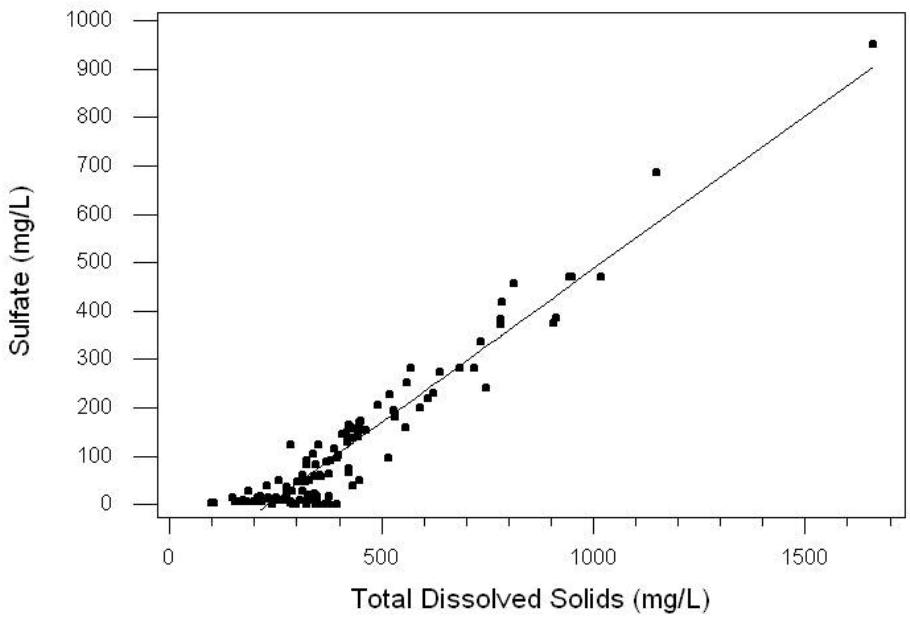


Figure 3.15-2
Relationship of Sulfate Concentrations to Total Dissolved Solids in Wasatch Groundwater

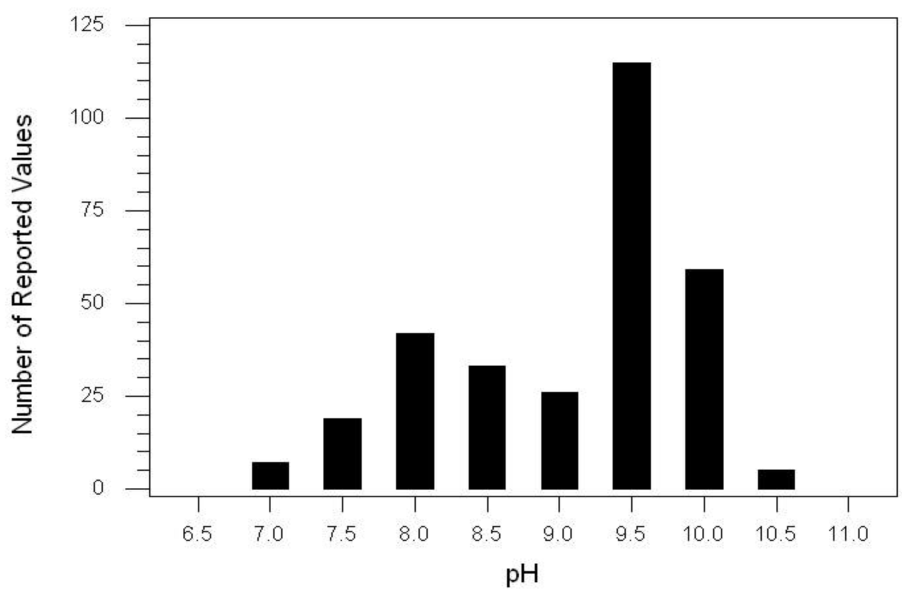


Figure 3.15-3
Distribution of pH in Wasatch Groundwater

Some groundwater is used for dust control. The quantity varies widely between Operators, estimates in 2005 range from 10,000 to 200,000 bbl/day. Use of groundwater for dust control is seasonal and depends on road surfaces in a particular work area, 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 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 average the Wasatch 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 is to the south as indicated in regional maps (Glover et al., 1998). Where the New Fork River crosses the anticline, potentiometric contours converge on the New Fork elevations, indicating that groundwater is flowing to the river; meaning 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 groundwater appears to flow toward the Green River, by-passing ephemeral watercourses draining east and west. There is less infiltration to groundwater, south of the New Fork River, where there is lower precipitation (USGS, 1985) and finer-grained soils.

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

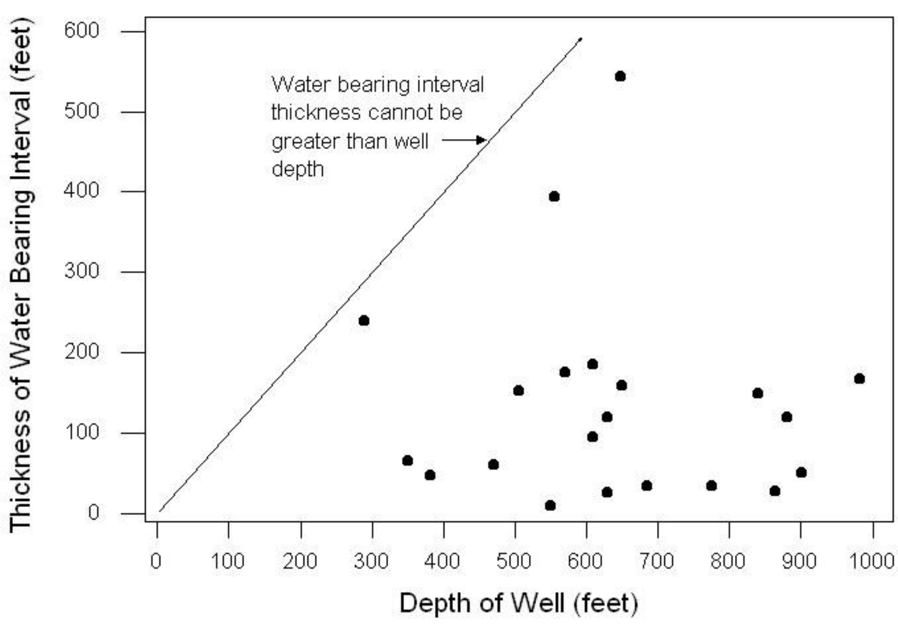


Figure 3.15-4
Data from Drilling Supply Wells in the PAPA

The nature of the local watercourse alluvium is not known, either north or south of the New Fork River, 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

Monitoring of groundwater for baseline characterization began following issuance of the PAPA ROD (BLM, 2000b). The PAPA ROD required that "… The Operators would conduct a survey and a complete water analysis (ex. 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."

Since July 2001, the Sublette County Conservation District (SCCD) has inventoried water wells within 1 mile of existing or proposed natural gas wells within the PAPA. SCCD sampled groundwater from August 23, 2004 through January 6, 2005 on behalf of PAPA Operators on over 230 wells. Many, if not most of these wells, have uncertain open intervals and they are in various sands of the Wasatch Formation. Because these sands are lenticular ancient river channel deposits within low permeability shales, sands cannot readily be correlated between borings and different units are intersected in each well. The Wasatch is therefore characterized by this baseline program as a compound aquifer system with variable chemistry.

In a letter to the Pinedale Field Office Manager dated August 15, 2005, WDEQ expressed concern that there is no consistent construction information for the wells being monitored by SCCD. Without this information, the monitored intervals are not known. BLM is addressing this concern through review of the monitoring program, in consultation with WDEQ.

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, Quaternary alluvium in river valleys, and some in eolian sands. Quaternary aquifers are thin and low-yielding except for where they are in direct contact with rivers. Tertiary aquifers consist of lenticular sands of the Wasatch Formation and 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, 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, 2004b). Well yields from the Wasatch aquifer system, the most extensive aquifer system in the Green River Basin, are typically between 20 and 500 gallons per minute. The average well depth in the portion of the Green River Basin within Sweetwater County is 385 feet (Hamerlinck and Arneson, 1998).

Groundwater quality varies by location and by aquifer (Hahn and Jessen, 2001) in the proposed corridor/pipeline alignment. The concentration of TDS exceeds the secondary drinking water standard in over 50 percent of the wells sampled, and sulfate exceeds the secondary drinking water standards in about 33 percent. 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 Within 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 anticline 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, in which there is little precipitation except for headwater snowpack accumulation. There are several reservoirs on New Fork tributaries which provide flood control, supply water to irrigation, as well as being recreational and fish and wildlife resources. South of the New Fork River, ephemeral streams 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 due to contributions from irrigation return flow, groundwater discharge, and runoff from salty soils in the lower reaches, but these two rivers are prime sport fishing waters over their entire lengths.

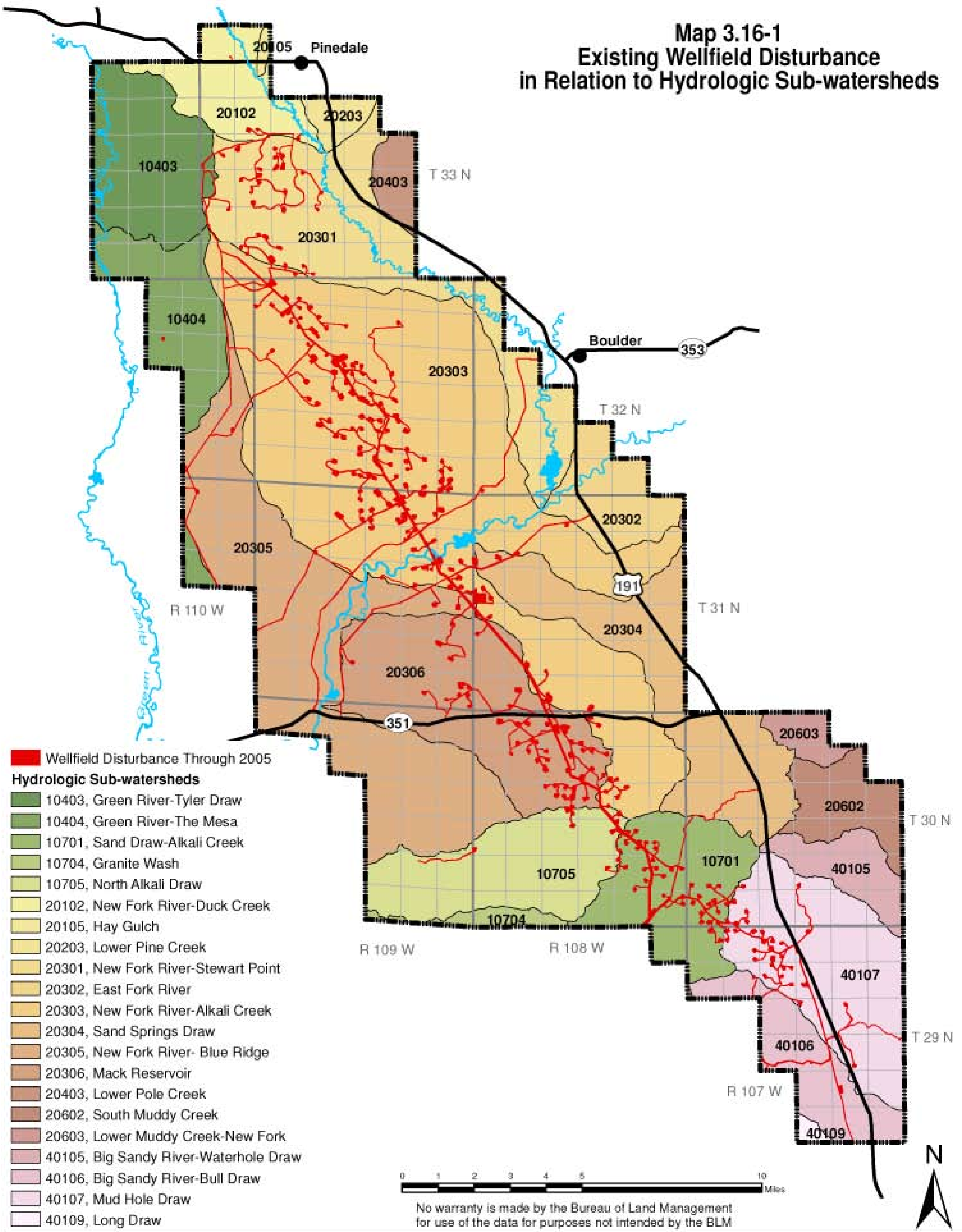
Three other perennial streams passing through the PAPA are Duck Creek, East Fork River, and Pine Creek. These are all tributaries to the New Fork River. However, most of the PAPA is drained by numerous ephemeral streams, each of which collect and drain water from small sub-watersheds within the PAPA. These streams also receive some seepage from groundwater, although this 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 (at Hydrologic Unit Code level 6 in USGS classification) draining the PAPA (see Map 3.16-1), although 10 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 in the southwest portion of the PAPA. The Green River is not present in the southwest portion of the PAPA. In the southeast portion of the PAPA, Water Hole Draw, Mud Hole Draw, Bull Draw, and other small drainages discharge to the Big Sandy River

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, 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, directed by BLM to implement a comprehensive program to minimize salt loading in the Colorado River Basin. BLM coordinates salinity control activities with the Colorado River Basin Salinity Control Forum (CRBSCF), the BOR, and the NRCS. BLM, BOR, 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, FWS, and the USGS.

The CRBSCF identified rapidly expanding energy development in the Upper Colorado River Basin as a high-priority issue because it has the potential of an adverse effect on achieving the


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
40105
10701
10705
10704
40107
40106
40109
Wellfield Disturbance Through 2005
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
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

adopted numeric salinity standards, which would violate the water-quality salinity-based standards and endanger downstream water users, and potentially affect the U.S. 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 Surface Water Standards (WDEQ, 2001), meaning that they 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 rules.

The SCCD monitors water in the streams of the New Fork basin quarterly. Details of the monitoring program can be 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.

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 BLM by December 1 of each year. They are reviewed with the public during the annual AEM review, as required by the PAPA ROD (BLM, 2000b).

A report by EcoAnalysts, Inc. (2005) concluded that there has been no discernible change in water chemistry, salt load, sediment load, or invertebrate biology indices in 5 years up to that time. 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 at upstream stations. EcoAnalysts inspected the bed for indications of increase in fine bed load which would impair aquatic life.

There are three 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 location where the New Fork River crosses the anticline. Data show that salinity (TDS) decreases down the northwest flank of the PAPA (from NF4 to NF30), then increases again across the anticline 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 anticline section. 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 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 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 confluence, below Alkali Creek. SCCD does not monitor water quality in the Green River, but USGS (1985) indicated suspended solids averaged 23 mg/L in the upper Green River above the PAPA.

EcoAnalysts (2005) has surveyed invertebrate life annually from the year 2000 at SCCD's monitoring points in the New Fork catchment to assess stream health based on aquatic insects (mayflies, stoneflies and caddis), which are thought to be sensitive to disturbance. Alternatively, abundance of nematodes, spiders and mites often indicate a stream is stressed. Samples taken at five sites within the New Fork catchment suggest stream health ranges from fair to very good, although, many more samples would be needed to confirm that evaluation.

3.16.1.3 Surface Water Quantity

The USGS maintains river gauging stations on the Green River near Daniel, north of the PAPA, to downstream of Fontenelle Reservoir, and in the New Fork River 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, below. The main tributaries to the Green River between the two gauges are the New Fork River, and Cottonwood, Big Piney, La Barge 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	Min annual average flow (cfs)	Mean annual average flow (cfs)	Max annual average flow (cfs)
Green River, Warren Bridge, near Daniel	09188500	1932-2005	295	500	768
Green River, below Fontenelle Reservoir	09211200	1964 - 2005	690	1600	3060
New Fork River near confluence with Green River	09205000	1954 - 2005	313	720	1109

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 (Wyoming State Engineer's Office, 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/yr, which is equivalent to 18 cubic feet per second (cfs).

3.16.1.4 Wellfield Development Effects

The sub-watersheds recognized by USGS (Map 3.16-1) are listed in Table 3.16-2 along with total surface area of the basins in the PAPA, and areas of surface disturbance by wellfield development as of December 2005 and that proposed by the Operators for 2006. Most surface disturbance has occurred within the Anticline Crest.

The Sand Draw-Alkali Creek and Mack Reservoir sub-watersheds have the most disturbance in the PAPA in proportion to their total areas. Over 5 percent of each basin in the PAPA has been disturbed as of December 2005. Other basins with relatively high surface disturbance by wellfield development include the New Fork River-Alkali Creek basin (4.2 percent); Mud Hole Draw basin (2.7 percent); and the New Fork River-Stewart Point basin (2.1 percent). In 2006, the Operators are proposing to disturb an additional 381 acres. Most disturbance would be within the New Fork River-Alkali Creek sub-watershed and Mack Reservoir sub-watershed, both of which drain to the New Fork River (Table 3.16-2).

3.16.1.5 Watershed Modeling

In August 2006, HydroGeo, Inc. modeled erosion and sediment loading of the current condition. The Technical Report - *Erosion Modeling, Transport Modeling, and Salt Loading, Pinedale Anticline Project, Sublette County Wyoming* is provided in Appendix J. Salt concentrations in stream water are 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 report concludes that there is currently negligible sediment

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

Sub-Watershed (HUC 6)	Sub-Basin	Hydrologic Unit Code	Total Surface Area in Basin (acres)	Surface Area of Basin in the PAPA (acres)	Percent of Basin in the PAPA	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance in Basin	Percentage Disturbance in the PAPA
Big Sandy River-Bull Draw	Big Sandy River	140401040106	19,768	5,761	29.1	74.2	0.0	74.2	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	1.5	0.0	1.5	0.0	0.0
Mud Hole Draw	Big Sandy River	140401040107	19,619	12,923	65.9	341.4	2.9	344.3	1.8	2.7
East Fork River	New Fork River	140401020302	25,005	4,885	19.5	12.0	0.0	12.0	0.0	0.2
Hay Gulch	New Fork River	140401020105	14,668	245	1.7	3.9	0.0	3.9	0.0	1.6
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	3.7	0.0	3.7	0.0	0.3
Lower Pole Creek	New Fork River	140401020403	20,119	1,757	8.7	0.9	0.0	0.9	0.0	0.1
Mack Reservoir	New Fork River	140401020306	15,353	15,353	100.0	771.3	79.0	850.3	5.5	5.5
New Fork River-Alkali Creek	New Fork River	140401020303	49,532	49,522	100.0	2,101.0	252.7	2353.7	4.8	4.8
New Fork River- Blue Ridge	New Fork River	140401020305	39,853	24,909	62.5	216.5	12.3	228.8	0.6	0.9
New Fork River-Duck Creek	New Fork River	140401020102	37,229	5,521	14.8	83.7	8.7	92.4	0.2	1.7
New Fork River-Stewart Point	New Fork River	140401020301	32,670	17,216	52.7	352.9	9.0	361.9	1.1	2.1
Sand Springs Draw	New Fork River	140401020304	19,073	13,207	69.2	77.6	3.7	81.3	0.4	0.6
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	10.1	0.0	10.1	0.0	0.1
Green River-Tyler Draw	Upper Green River	140401010403	34,761	8,834	25.4	21.7	0.0	21.7	0.1	0.2
North Alkali Draw	Upper Green River	140401010705	15,918	9,959	62.6	116.1	0.4	116.5	0.7	1.2
Sand Draw-Alkali Creek	Upper Green River	140401010701	22,941	9,004	39.2	490.0	12.2	502.2	2.2	5.6
Total				**198,034**		**4,678.5**	**380.9**	**5,059.4**		

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. An average of 800 metric tons of sediment is mobilized each year in the PAPA under current conditions, according to the model. Much of the sediment mobilization occurs at low storm frequencies, but sediment largely remains within the lower basins until larger storms move it out of the basins. 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 occasion a new pad generates runoff.

Modeling indicates that current disturbances do not contribute significantly more sediment transport than would the 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. Similarly salt yield off the PAPA, through leaching of dissolved solids in soils, has probably not significantly increased due to gas development to date, except in those same sub-watersheds.

3.16.1.6 Produced Water

Produced water from the Lance Formation is suitable only for industrial use, due to elevated TDS, sulfate and hydrocarbons. Some of it is treated and re-used or discharged, and some is disposed in off-site, deep injection wells. Some treated water (with additional reverse osmosis) has been used on a trial basis for dust control.

There is currently one water treatment facility handling PAPA produced water, the Anticline Disposal Facility. Produced water is either piped or trucked to the Anticline Disposal Facility, depending on the Operator. Between 40 and 60 percent of water used in well completions (fracturing) is produced water with minimal or no treatment. The balance of the water used for completions is more extensively treated water or Wasatch groundwater. Approximately 25,000 to 40,000 barrels of water are used in a single well completion, of which about half 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. One method of disposal is in deep injection wells at Big Piney. Anticline Disposal has a discharge permit (WY 0054224, May 2006) for up to 630,000 gpd (approximately 1 cfs) treated water, 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 plans to begin discharge of treated produced water in 2007. Discharged water must pass toxicity testing, and 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 by biotreatment and filtration. The Hydro-Action Portable Sewage Facility has a discharge permit (05-070, March 05), valid for all counties in Wyoming, to discharge treated “gray water” by sprinkler, up to 4 inches per week. 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 State Engineers Office (SEO). There must provisions for protection of fish at the pump intake. Hydrostatic test water is discharged to the surface following testing, making sure 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 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 Pipeline

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 has been designated as Class 2AB by 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 has been designated as Class 2AB at these locations (WDEQ, 2001). The OPC and the Opal Loop III Pipeline cross the Blacks Fork River, which has been designated as Class 2AB by WDEQ (2001).

None of the river segments crossed by the proposed corridor/pipeline alignments are included on Wyoming's Section 303(d) 2006 list of impaired waters, with the exception of the Blacks Fork River. 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, seeps; 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 Within 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 slope of 15 percent or greater) in the PAPA comprise the Sensitive Soils SRMZ. The SRMZ also encompasses the Blue Rim Area of the southern PAPA (Map 3-17-1). 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. To the extent it was available; these data were used for watershed modeling.

As of December 2005, approximately 241 acres of soils with slopes over 15 percent and 525 acres of the Blue Rim soils were disturbed as a result of natural gas development (Table 3.17-1). Most surface disturbance to sensitive soils has been within 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). In 2006, the Operators are projecting an additional 26 acres of disturbance in soils with slopes over 15 percent, and approximately 65 acres are likely to be within sensitive soils of the Blue Rim Area (Table 3.17-1). Within the combined area that comprises the Sensitive Soils SRMZ, 707 acres had been disturbed in 2005 and an additional 80 acres of disturbance is projected for 2006.

Table 3.17-1
Estimated Existing Wellfield Disturbance in Relation to Sensitive Soils in the PAPA

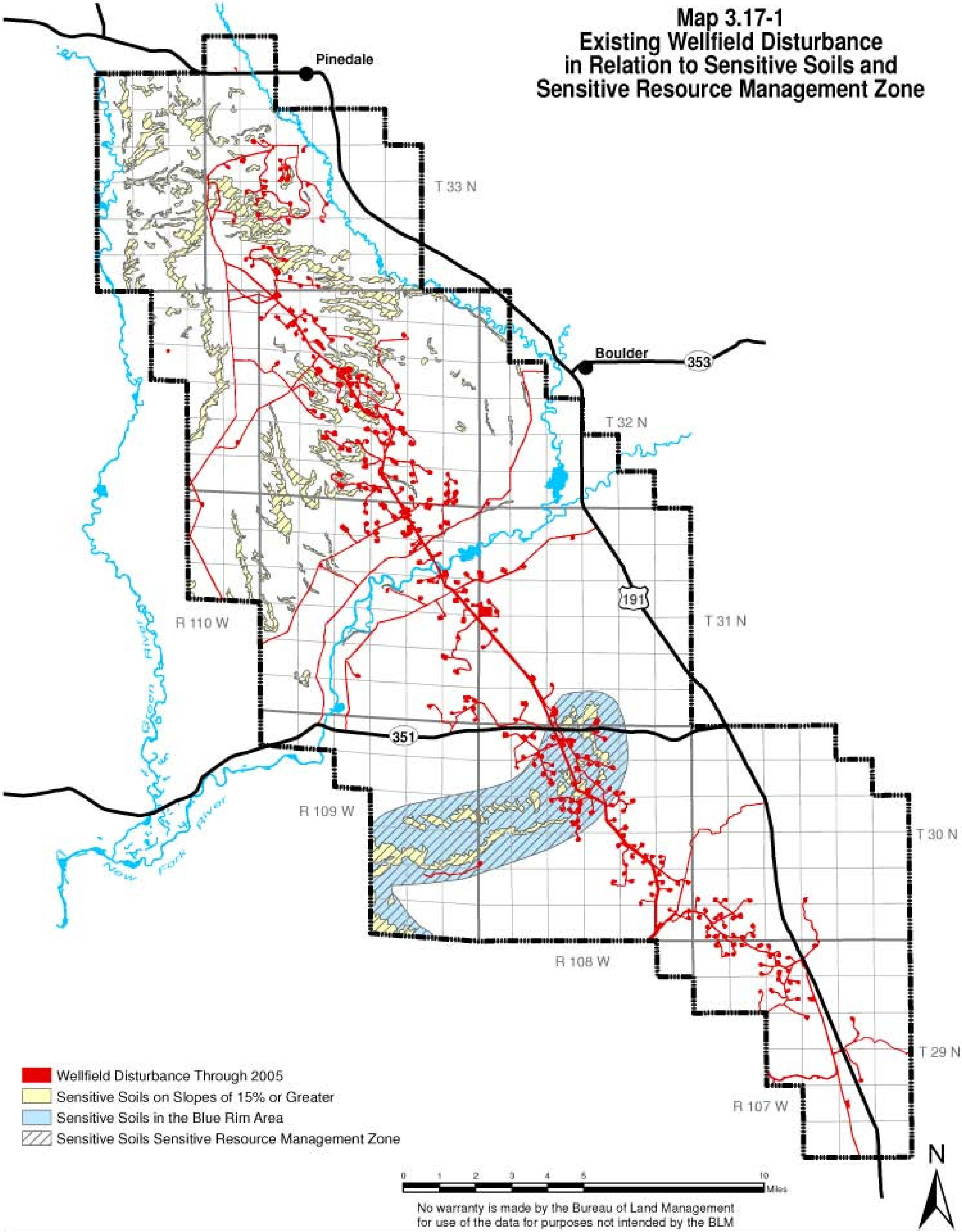
Sensitive Soils Category	Surface Area (acres) in the PAPA	Surface Disturbance through December 2005	Estimated Additional Surface Disturbance in 2006 [3]	Estimated Total Existing Surface Disturbance	Percentage Disturbance
Blue Rim Area Sensitive Soils	12,925	525.1	64.8	589.9	4.6
Sensitive Soils on slopes ≥ 15%	11,044	240.8	26.1	266.9	2.4
Sensitive Soils SRMZ	21,645	706.5	80.4	786.9	3.6

[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 and are the principal parent materials for soils. Slopes range from nearly level to steeply sloping.

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



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

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, and their mostly shallow depth limits their water holding capacity, causing them to be droughty limiting their reclamation potential.

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 alignment, 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 also 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 Within 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 December 2005, wellfield activities have resulted in more than 3,500 acres of disturbance to sagebrush, approximately 2.4 percent of all sagebrush-dominated vegetation in the PAPA. A large portion of mixed grasslands (371 acres or 3.1 percent) has also been disturbed (Table 3.18-1).

Surface disturbance in 2006 would likewise mostly affect big sagebrush steppe vegetation, because 270 acres of the approximate 381 acres is projected to be disturbed within that vegetation category (Table 3.18-1).

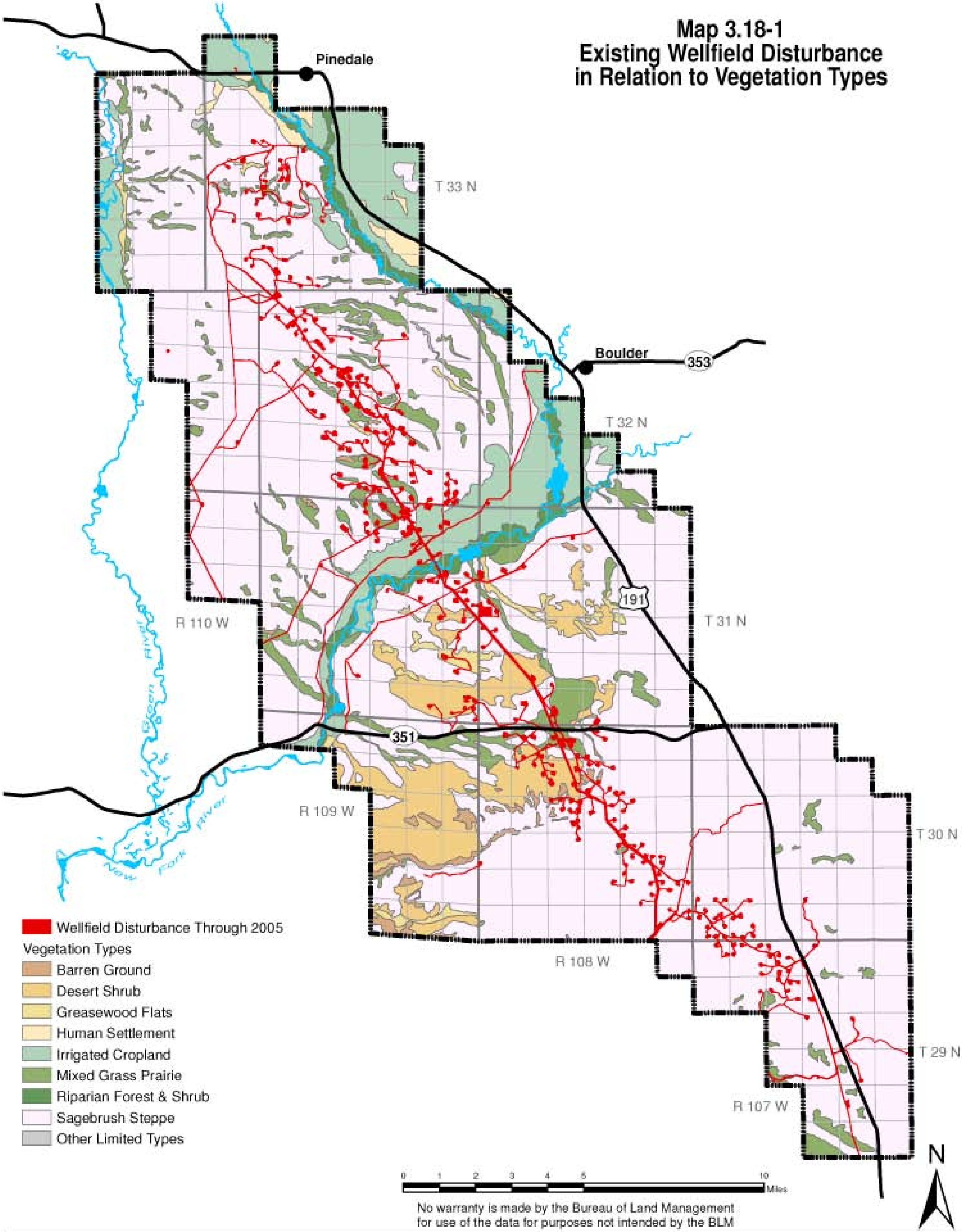

Map 3.18-1
Existing Wellfield Disturbance
in Relation to Vegetation Types
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Vegetation Types
Barren Ground
Desert Shrub
Greasewood Flats
Human Settlement
Irrigated Cropland
Mixed Grass Prairie
Riparian Forest & Shrub
Sagebrush Steppe
Other Limited Types
0 1 2 3 4 5 10 Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Table 3.18-1
Estimated Existing Wellfield Disturbance to Vegetation Types in the PAPA

Vegetation Category	Surface Area) in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Sagebrush steppe	147,164	3,594.0	270.1	3,864.1	2.6
Mixed grass prairie	11,815	371.3	37.8	409.1	3.5
Greasewood flats	1,936	40.5	6.4	46.9	2.4
Desert shrub	11,560	266.3	20.2	286.5	2.5
Riparian forest and shrub	4,348	54.4	16.0	70.4	1.6
Other limited types	324	3.6	0.0	3.6	1.1
Barren ground	1,702	40.9	4.9	45.8	2.7
Irrigated cropland	17,677	285.4	25.5	310.9	1.8
Human settlement	1,508	22.1	0.00	22.1	1.5
Total	**198,034**	**4678.5**	**380.9**	**5,059.4**	**2.6**

Growth, or production, of sagebrush on the Mesa has been evaluated by WGFD since 2004 (Scribner, 2006). Production, measured as average length of sagebrush leaders was greatest (1.25 inches) in 2004 following a winter with average snowfall and above average precipitation for the water year (see Table 3.3-1 and Appendix K, 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 but sagebrush production on the Mesa, measured in 2006, was least of all 3 years, averaging only 0.12 inches (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, see 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 nonnative species, many of which are classified as noxious weeds, are very aggressive and have the ability to dominate many sites with dramatic impacts to native plant communities. 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 13 state-designated noxious weeds and two county-declared weeds in Sublette County (Wyoming Weed and Pest Council, 2006). The declared county weeds are black henbane and scentless chamomile. 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 2003	Wyoming Designated Noxious Weed [1]	Sublette County Declared Weed [2]	Weed of Concern in PAPA DEIS
Black henbane *Hyoscyamus niger*	1-100	No	Yes	Yes
Canada thistle *Cirsium arvense*	5,000-20,000	Yes	–	Yes
Common tansy *Tanacetum vulgare*	1-100	Yes	–	No
Dyer's Woad *Isatis tinctoria*	1-100	Yes	–	Yes
Hoary cress (whitetops) *Cardaria draba*	100-1,000	Yes	–	Yes
Leafy spurge *Euphorbia esula*	1-100	Yes	–	Yes
Musk thistle *Carduus nutans*	1-100	Yes	–	Yes
Perennial pepperweed *Lepidium latifolium*	1,000-5,000	Yes	–	Yes
Perennial sowthistle *Sonchus arvensis*	1-100	Yes	–	Yes
Quackgrass *Agropyron repens*	1-100	Yes	–	No
Russian knapweed *Centaurea repens*	100-1,000	Yes	–	Yes
Scentless chamomile *Matricaria perforate*	1-100	No	Yes	No
Spotted knapweed *Centaurea maculosa*	1-100	Yes	–	Yes
Yellow toadflax *Linaria vulgaris*	1-100	Yes	–	No

[1] A Designated Noxious Weed listing provides the State of Wyoming legal authority to regulate and manage noxious weeds.
[2] A County Declared Weed listing provides that county with legal authority to regulate and manage noxious weeds.
Source: Wyoming Weed and Pest Council, 2006.

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 varies from sparse low-structure sagebrush interspersed with grasses and forbs in the understory, to other 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. While species vary by soil type and ground use history, they 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-ways are susceptible to infestations of invasive/noxious weeds such as Canada thistle, musk thistle, black henbane, and halogeton. Field surveys in 2006 revealed that halogeton is present in many areas along the existing pipeline rights-of-ways (Grasslands, 2006). Table 3.18-3 contains a list of invasive non-native species in Sublette, Sweetwater, and Uinta counties that are known or suspected to occur (Wyoming Weed and Pest Council, 2006).

Table 3.18-3
Invasive Nonnative Species Known to Occur in Sublette, Sweetwater, and Uinta Counties that May Occur Along the Proposed Corridor/Pipeline Alignments

Common Name Scientific Name	Sublette County	Sweetwater County	Uinta 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	
Lady's bedstraw *Galium verum*		present	
Mountain thermopsis *Thermopsis Montana*		present	
Yellow starthistle *Centaurea solstitialis*			present

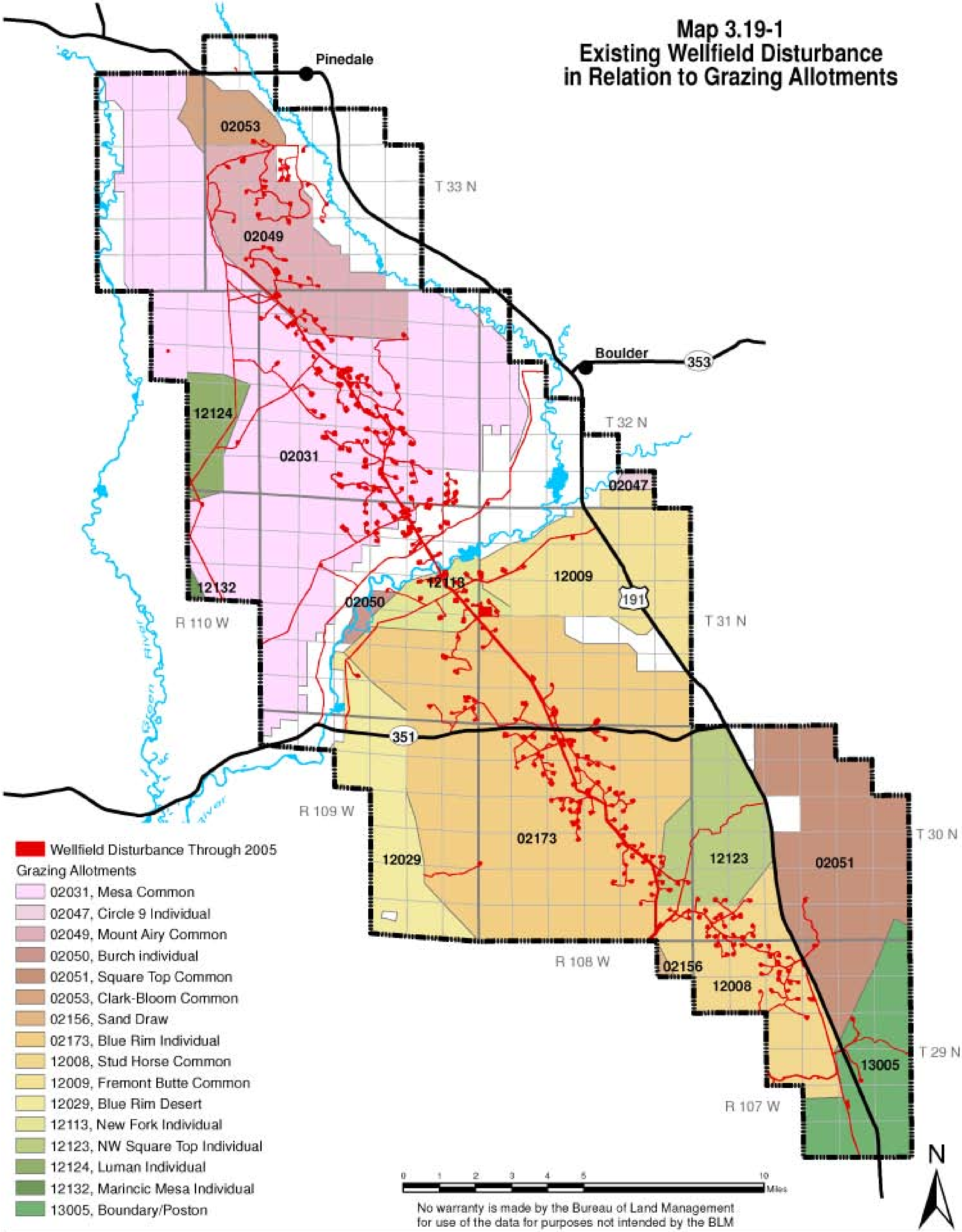
3.19 GRAZING RESOURCES

3.19.1 Development Within 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 management categories for area allotments have not changed since the PAPA ROD was issued (BLM, 2003a). There have been no 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 can be seen below, on Map 3.20-1, indicated as point locations included within the Wetland SRMZ.

BLM has reported inadequate fencing around pits and tanks. Increased vehicular traffic has caused several livestock deaths in the PAPA since the PAPA ROD (BLM, 2000b) was issued.


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
02047
12009
12113
02050
02173
12029
12123
02051
02156
12008
13005
Wellfield Disturbance Through 2005
Grazing Allotments
02031, Mesa Common
02047, Circle 9 Individual
02049, Mount Airy Common
02050, Burch individual
02051, Square Top Common
02053, Clark-Bloom Common
02156, Sand Draw
02173, Blue Rim Individual
12008, Stud Horse Common
12009, Fremont Butte Common
12029, Blue Rim Desert
12113, New Fork Individual
12123, NW Square Top Individual
12124, Luman Individual
12132, Marincic Mesa Individual
13005, Boundary/Poston
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

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 (see Section 3.3 and Table 3.3-1, Section 3.18.1, and Appendix K, Wildlife Technical Report). The number of livestock grazing on the 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 coinciding with 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. Thus, the most land to support one AUM was within the Marincic Mesa Individual allotment (No. 2132), which averaged 16.92 acres per AUM. The least land to support one AUM was in the Luman Individual allotment (No. 2124), 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 about 10.52 acres or an average of 0.095 AUM per acre.

Grazing allotments that coincide with 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 December 2005, the amount of surface disturbance in all allotments was approximately 4,094 acres, which would support 389 AUMs, using the average AUMs per acre on the PAPA discussed above. In 2006, 336 acres are projected to be disturbed, which is approximately 32 AUMs (Table 3.19-1). Most surface disturbance in the PAPA that is not yet revegetated would be reclaimed, and so estimated loss of AUMs is a current condition but is expected to be temporary.

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

Allotment and Number	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Blue Rim Individual (2173)	40,488	1,294.2	107.7	1401.9	3.5
Circle 9 Individual (2124)	429	0.0	0.0	00.0	0.0
Clark-Bloom Common (2053)	2676	35.3	4.7	40.0	1.5
Blue Rim Desert (2029)	7809	15.5	0.0	15.5	0.2
Fremont Butte Common (2009)	11,249	77.7	3.7	81.4	0.7
Luman Individual (2124)	2644	11.4	0.0	11.4	0.4
Marincic Mesa Individual (2132)	184	0.2	0.0	0.2	0.1
Mesa Common (2031)	48309	1278.5	146.9	1425.4	3.0
Mount Airy Common (2049)	9512	359.0	19.6	378.6	4.0
New Fork Individual (2113)	2,604	280.4	40.4	320.8	12.3
Burch (2050)	662	7.9	0.0	7.9	1.2
Northwest Square Top Individual (2123)	6,841	112.9	9.8	122.7	1.8
Square Top Common (2051)	15000	62.1	0.0	62.1	0.4
Stud Horse Common (2008)	9920	505.0	3.0	508.0	5.1
Boundary/Poston (13005)	7266	54.2	0.0	54.2	0.7
Sand Draw (2156)	145	0.0	0.0	0.0	0.0
Total	**165,738**	**4,094.3**	**335.8**	**4430.1**	**2.7**

3.19.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would cross portions of 13 grazing allotments within the Pinedale, Rock Springs and Kemmerer field offices (Table 3.19-2). Most of these allotments are designated for use by sheep and cattle or by cattle only. Season of use varies among allotments.

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

Allotment	Allotment Area (acres)	Allotment AUMs	Livestock Type	Season of Use
Mesa Common (2031)[1]	55,789	4,701	Cattle/horses	5/16-6/25 10/1-11/15
New Fork Individual (2113)[1]	1,850	302	Cattle	5/10-6/20
Blue Rim Individual (2173)[1]	36,585	3,258	Cattle	5/10-6/23
Sand Draw (2156)[1]	31,740	2,324	Cattle	5/1-6/26
Blue Rim Desert (2029)[1]	39,609	2,826	Cattle	5/1-6/21
South Desert (2040)[1]	34,564	2,621	Cattle	5/1-8/23
Figure Four (13023)[2]	114,425	6,644	Sheep/cattle	5/10-1/10
Eighteen-Mile (13017)[2]	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)[3]	12,555	298	Horse Sheep/cattle	All year 5/1-12/31
Slate Creek (11113)[3]	267,048	20,780	Sheep/cattle	4/15-11/30
Granger Lease (11302)[3]	467,059	20,430	Sheep/cattle	Dec-Apr/May-Oct
1=Pinedale, 2=Rock Springs, 3=Kemmerer Source: Schulz, 2006; D'Ewart, 2006 and Burgin, 2006.				

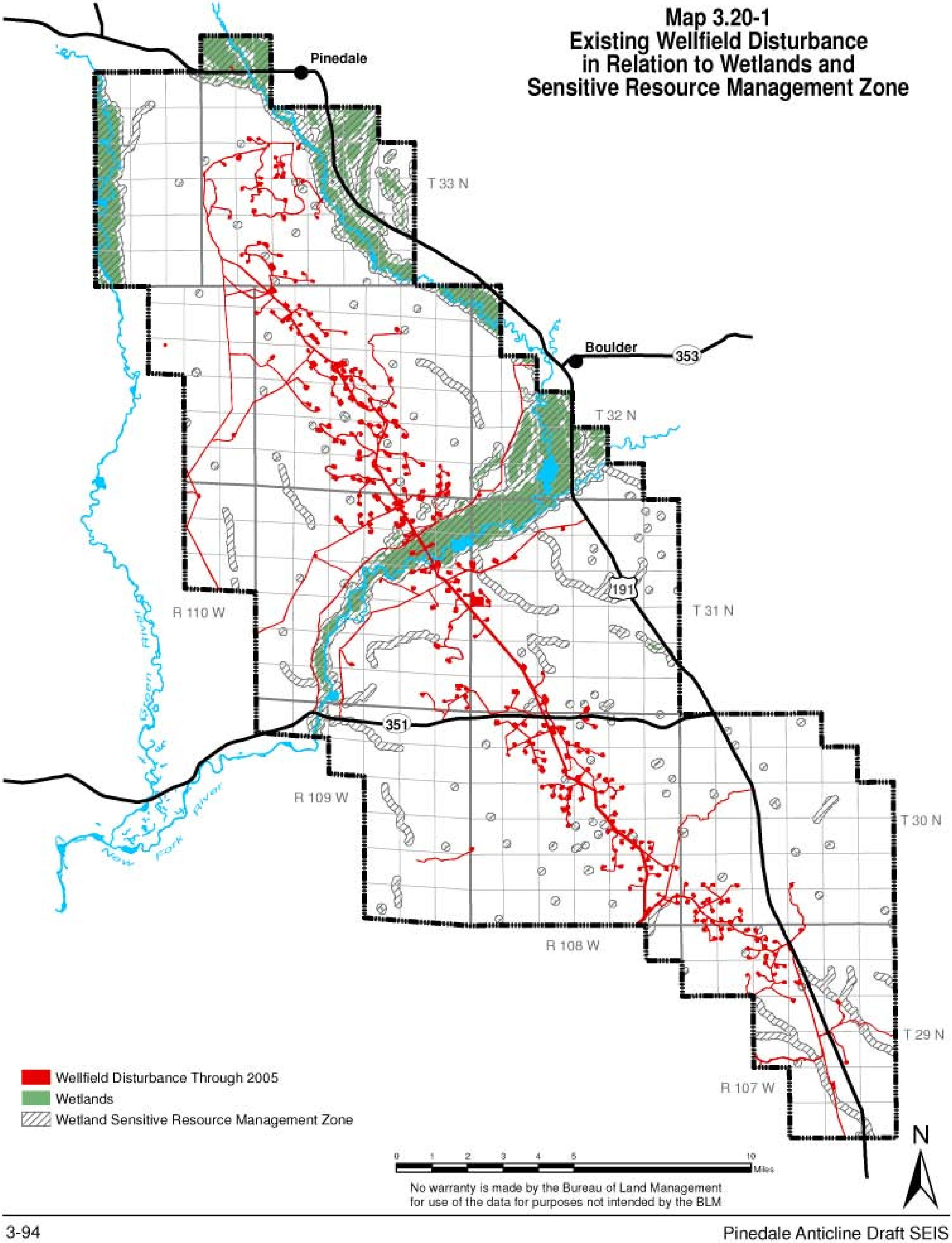
3.20 WETLANDS, RIPARIAN RESOURCES AND FLOOD PLAINS

3.20.1 Development Within 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 for administering 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 Part 230.3 and 33 CFR Part 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 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 Part 230.3, 33 CFR Part 328.3, and Executive Order 11990 (Map 3.20-1).

Map 3.20-1 Existing Wellfield Disturbance in Relation to Wetlands and Sensitive Resource Management Zone



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.

Since issuance of the PAPA ROD (BLM, 2000b), relatively little surface disturbance associated with wellfield development has occurred in wetlands (Table 3.20-1). Most of the surface disturbance (22 acres) has been generated during pipeline construction since July 2000. There is additional surface disturbance within the 500-foot zone surrounding every wetland that defines the Wetland SRMZ. In that zone, most disturbances have been due to road construction, with approximately equal contributions from well pads and pipelines (Table 3.20-1). Similar to wetlands, there have been relatively few surface disturbances within the 100-year flood plain and within the Flood Plain SRMZ (Map 3.20-2). Most disturbances have been due to pipeline construction.

Table 3.20-1
Estimated Existing Wellfield Disturbance in Relation to Wetlands, the Wetland SRMZ, and Flood Plains in the PAPA

Sensitive Resource	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Wetlands	13,482	131.3	18.4	149.7	1.1
Wetland SRMZ	17,963	248.8	26.3	275.1	1.5
100-Year Flood Plain and Flood Plain SRMZ	11,022	160.4	21.6	182.0	1.7

[1] Only includes jurisdictional wetlands defined in the FWS National Wetland Inventory.

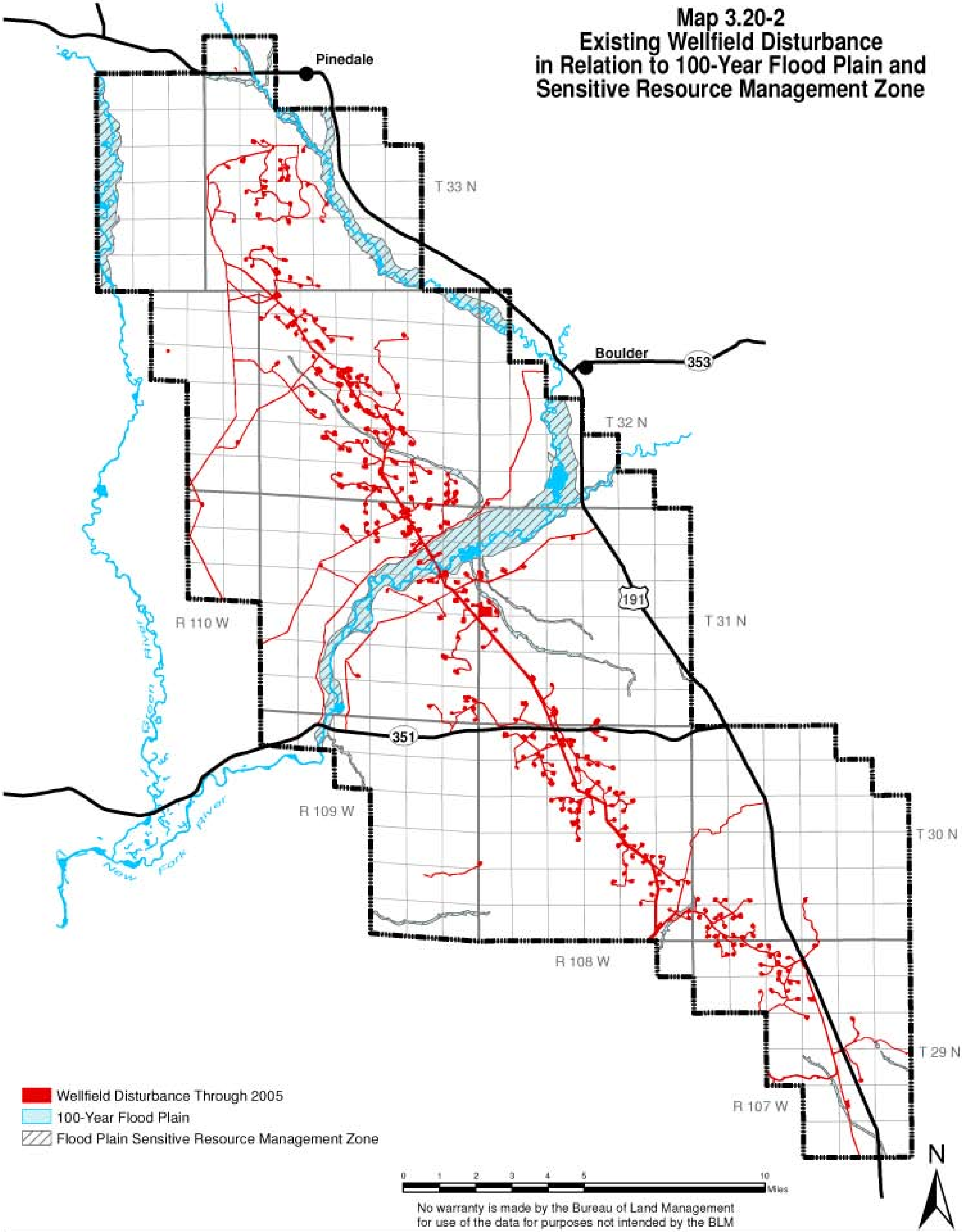
Wetlands in Table 3.20-1 include wet meadows and all of the irrigated hay fields and pastures above the New Fork River's flood plain that may not be jurisdictional wetlands. Most of the wetlands in the PAPA occur along the flood plains of the Green and New Fork rivers and most (96 percent) are on private and state lands. Because of agriculture and residential developments on private lands, the total areas affected by various human-related disturbances to wetlands and the Wetland SRMZ before approval of the PAPA ROD (BLM, 2000b) is quite extensive (Table 3.20-1). Disturbance, especially associated with agriculture, is vegetated, unlike well pads and roads that have been constructed in the Wetland and Flood Plain SRMZs since July 2000.

In 2006, the Operators are projecting an additional 381 acres of disturbance. At the end of 2006, an estimated 18 acres are projected in wetlands, while 22 acres are projected in the Wetland SRMZ and 26 acres in the Flood Plain SRMZ (Table 3.20-1).

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. Wetlands are primarily expressed as

Map 3.20-2 Existing Wellfield Disturbance in Relation to 100-Year Flood Plain and Sensitive Resource Management Zone



emergent herbaceous vegetation consisting of sedges and rushes. This wetland vegetation type is present along the river banks of the Blacks Fork and Green rivers. Emergent wetlands are present within the flood plain of the New Fork River. 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 Within 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 swift fox was a candidate species for listing under the ESA. Since 2000, Canada lynx have been listed as threatened (FWS, 2000) while the proposal to list mountain plovers as threatened was withdrawn (FWS, 2003b). Swift fox is no longer considered to occur in the region.

Recently, the FWS (2005b) in a written communication to the BLM 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). 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 that FWS (2005b) identified as sensitive (greater sage-grouse and pygmy rabbit).

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 FWS (2004a) evaluated the potential for prairie dog colonies in Wyoming to support black-footed ferrets. As a result, the FWS has determined there are many areas in the state not likely to be inhabited by the species, based on habitat quality and likelihood that ferrets, if ever they were present, are now extirpated. The FWS (2004a) determined that approximately 64 square miles of the PAPA (all or portions of Townships 29 through 31 North, and Ranges 109 through 111 West) 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).

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 (FWS, 1982), approximately 30 miles north of Pinedale.

Colorado River Fish. The FWS (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 FWS proposed to remove the bald eagle from the list of threatened and endangered species in 1999 (FWS, 1999); but delisting has not occurred and they remain a threatened species. Bald eagles nesting in northwestern 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 (FWS, 2005b), 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 within the PFO Administrative Area. A total of 54 eagles were counted, most of them along the Green River and 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 2004 and 2005, there were two active bald eagle nests within 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. 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 FWS, 2005b). Fledged juvenile bald eagles may remain in the nest vicinity for a month, often through August (Isaacs et al., 1983 and FWS, 2005b).

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). 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 more well pads have been constructed within that 1 mile zone. By the end of 2005, a total of 626 acres had been disturbed by wellfield development within 1 mile of the New Fork River riparian zone. By the end of 2006, four more pads are expected to be constructed within 1 mile of the New Fork River riparian zone and those, along with associated roads and pipelines, are estimated to disturb an additional 57 acres (Table 3.21-1).

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

Habitat Component	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
1 mile of Active Bald Eagle Nests	4,000	48.7	0.0	48.7	1.2
1 mile of New Fork River Riparian Zone	38,160	766.1	62. 0	828.1	2.2
Forested Dominated Riparian Vegetation	4,036	49.0	15.9	64.9	1.6

Grizzly Bear. The entire PAPA is outside of 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 (FWS, 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, whether due to seasonal flooding or sub-irrigation (Fertig, 2000). All four of the known populations in the state occur in Wyoming's eastern half. 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 FWS (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 (FWS 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 (FWS et al., 2006). The animals are classified as a nonessential experimental population (FWS, 2005b). 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 (FWS 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 dispersed to the Pinedale/Cora area and were subsequently killed after repeated livestock depredations (FWS et al., 2005). 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. All were killed after repeated documented livestock depredations (Urbigkit, 2006).

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, 2006a). Wolves killed 16 elk on the Black Butte and Soda Lake feedgrounds within the Green River Elk Herd Unit during 2003 (Clause, 2006b). 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 FWS (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 (FWS, 2005b). The species is found in eastern Wyoming where it is associated with deciduous woods and thickets along riparian zones (Dorn and Dorn, 1990; 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, some of which have been surveyed since 1980, although none with continuous records since then. Yellow-billed cuckoos have not been reported in any of the surveys in the PAPA vicinity. Further, BBS routes in 2002 on BLM 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 within the subspecies' range. However, the FWS 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 (FWS, 2004d). A similar evaluation was rendered on a petition to list the western subspecies in 2003.

The FWS 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 (FWS, 2005c). Greater sage-grouse are managed as an upland game bird in Wyoming and the species is discussed in Section 3.22.1.2, below. 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 (FWS, 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, 2001) as well as by the FWS (FWS, 2005a). Pygmy rabbits use subspecies of sagebrush and other shrub species (like 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 currently 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, 2001) within the Pinedale and Rock Springs resource areas, some of which are known to occur or potentially occur in the PAPA. 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). Other species' occurrences, listed 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).

Species of Special Concern managed by WGFD and which may inhabit the PAPA have been included 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 (2001) has indicated that the following special status plant species may occur within the Pinedale Resource Area: Cedar Rim thistle, large-fruited bladderpod, Beaver Rim phlox, and tufted twinpod (Table 3.21-3). Trelease's racemose milkvetch could occur if suitable habitat is present.

Table 3.21-2
BLM Sensitive Fish and Wildlife Species and WGFD Species of Special Concern Not Listed Under ESA That Could Occur Within the PAPA, Habitats, and Other Status Designations

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
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

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Mountain plover *Charadrius montanus*	Grasslands	present	S2	NSS4
Long-billed curlew *Numenius americanus*	Grasslands, plains, foothills, wet meadows	possible	S3B	NSS3
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
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

[1] State Rank: Assigned by WYNDD and reflects status of species within political borders of the State 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.

[2] 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.

Sources: BLM, 2001, Keinath et al., 2003; Cerovski et al., 2004

Table 3.21-3
BLM-Sensitive Plant Species Not Listed Under ESA
That Could Occur within the PAPA, Habitats, and Other Status Designations

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 4950-7900' elevation	highly unlikely	S2
Trelease's racemose milkvetch *Astragalus racemosus* var. *treleasei*	Sparsely vegetated sagebrush on shale or limestone outcrops, barren clay slopes, 6500-8200' elevation	possible	S2
Cedar Rim thistle *Cirsium aridum*	Barren, chalky hills, gravelly slopes, fine textured sandy-shaley draws, 6700-7200' elevation	likely	S2
Large-fruited bladderpod *Lesquerella macrocarpa*	Gypsum-clay hills, benches, clay flats, barren hills, 7200-7700' elevation	likely	S2
Beaver Rim phlox *Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, limestone substrates, 6000-7400' elevation	likely	S2
Tufted twinpod *Physaria condensate*	Sparsely vegetated shale slopes, ridges, 6500-7000' elevation	likely	S2

[1] State Rank: assigned by WYNDD and reflects status of species within political borders of the State 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
Source: BLM, 2001; Keinath et al., 2003.

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 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 likely 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 Rock Springs and Kemmerer field offices 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, in addition to those in Table 3.21-2 and Table 3.21-3, Could Occur within the Vicinity of the Proposed Corridor/Pipeline Alignments

Common Name Scientific Name	Habitat (BLM, 2001)	Potential Occurrence	State Rank[1]	WGFD Status[2]
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

Common Name Scientific Name	Habitat (BLM, 2001)	Potential Occurrence	State Rank[1]	WGFD Status[2]
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	-
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	-
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	-
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	-
Ownbey's thistle *Cirsium ownbeyi*	Sparsely vegetated shaley slopes in sage and juniper communities between 6,440-8,400 feet	Highly unlikely	S2	-
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	-
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	-
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	-
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	-
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	-
Persistent sepal yellowcress *Rorippa calycina*	Sandy, muddy streambanks, stockponds, reservoirs 3,660-6,800 feet elevation	Unlikely	S2S3	
Green River greenthread *Thelesperma caespitosum*	Occurs along white shale slopes and ridges of the Green River Formation at 6,300 feet	Highly unlikely	S1	-
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	-
Cedar Mountain Easter-daisy *Townsendia microcephala*	Sweetwater and Uinta counties in the Blacks Fork drainage on rocky slopes and cobbley ridges of the Bishop Conglomerate	Highly unlikely	S1	-

[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 Within 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 (2004b) 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.*

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 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, 2004c). 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, 2006b) has not shown a trend of mortality related to traffic volume.

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 (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).

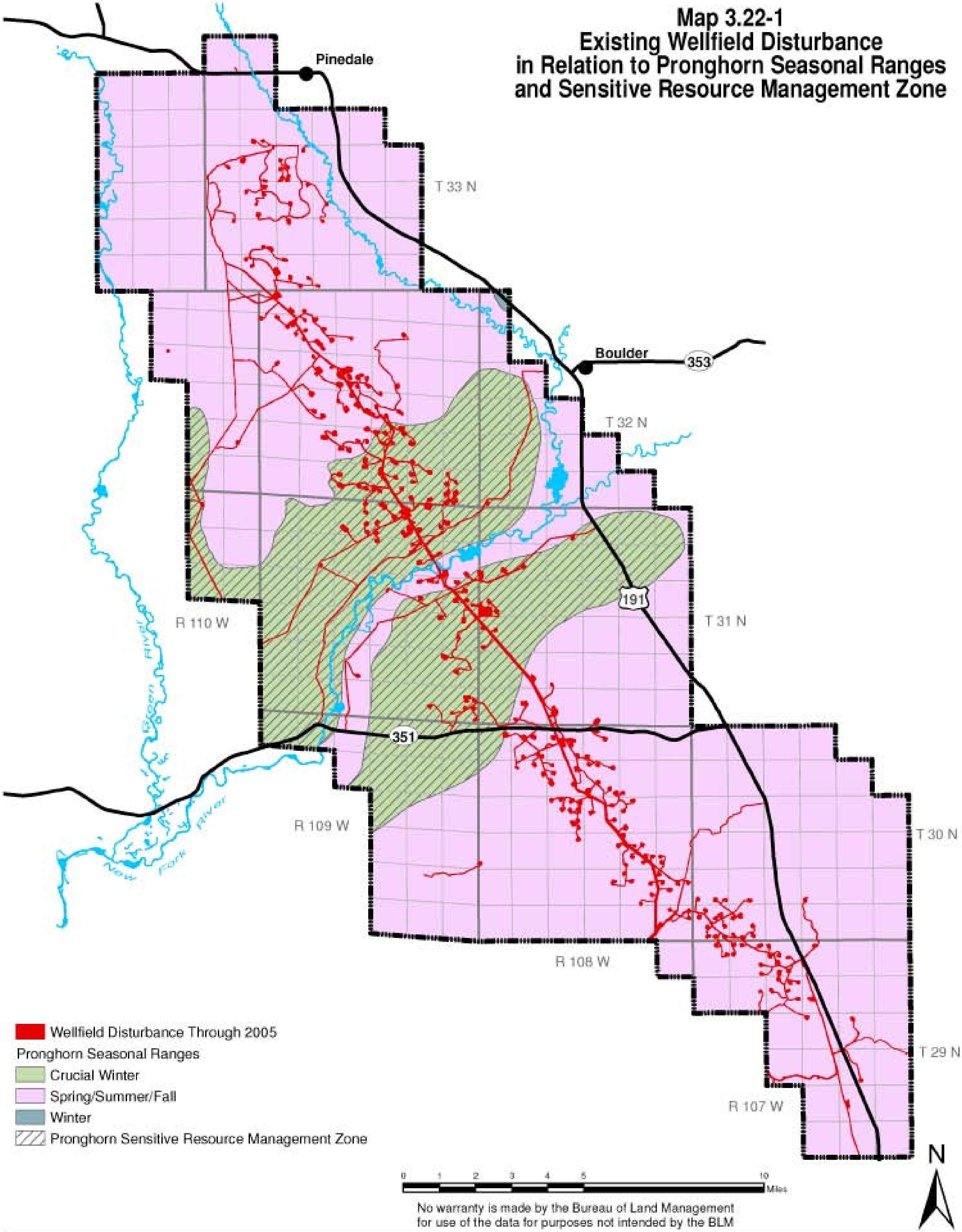

Map 3.22-1
Existing Wellfield Disturbance
in Relation to Pronghorn Seasonal Ranges
and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Pronghorn Seasonal Ranges
Crucial Winter
Spring/Summer/Fall
Winter
Pronghorn 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

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

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Green River Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

Pronghorn fawn production within the entire herd unit increased during 2004, a likely response to increased precipitation during water year 2003-2004. 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 (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. Of particular interest is fawn production in the northern portion, which is less than in the entire herd unit each year since 1999. 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

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Green River Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

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 significant (Berger et al., 2006).

Pronghorn were radio-collared to study movements in relation to snow depth and wellfield activities. When snow is deep, larger groups of pronghorn tend to form; snow tended to be deeper in the north end than the south end of the PAPA. Generally, 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 suggest that continual fragmentation of previously undisturbed land is leading to reduced use by pronghorn. Pronghorn appear to abandon habitat in parcels with patch sizes at or about 600 acres (Berger et al., 2006).

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 (Antelope) 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 December 2005, there were approximately 4,679 acres of wellfield disturbance in the PAPA (all of which is in pronghorn seasonal ranges).

By the end of 2006, 381 additional acres are projected to be disturbed mostly in spring/summer/fall ranges but a relatively larger proportion would be within crucial winter range (Table 3.22-3).

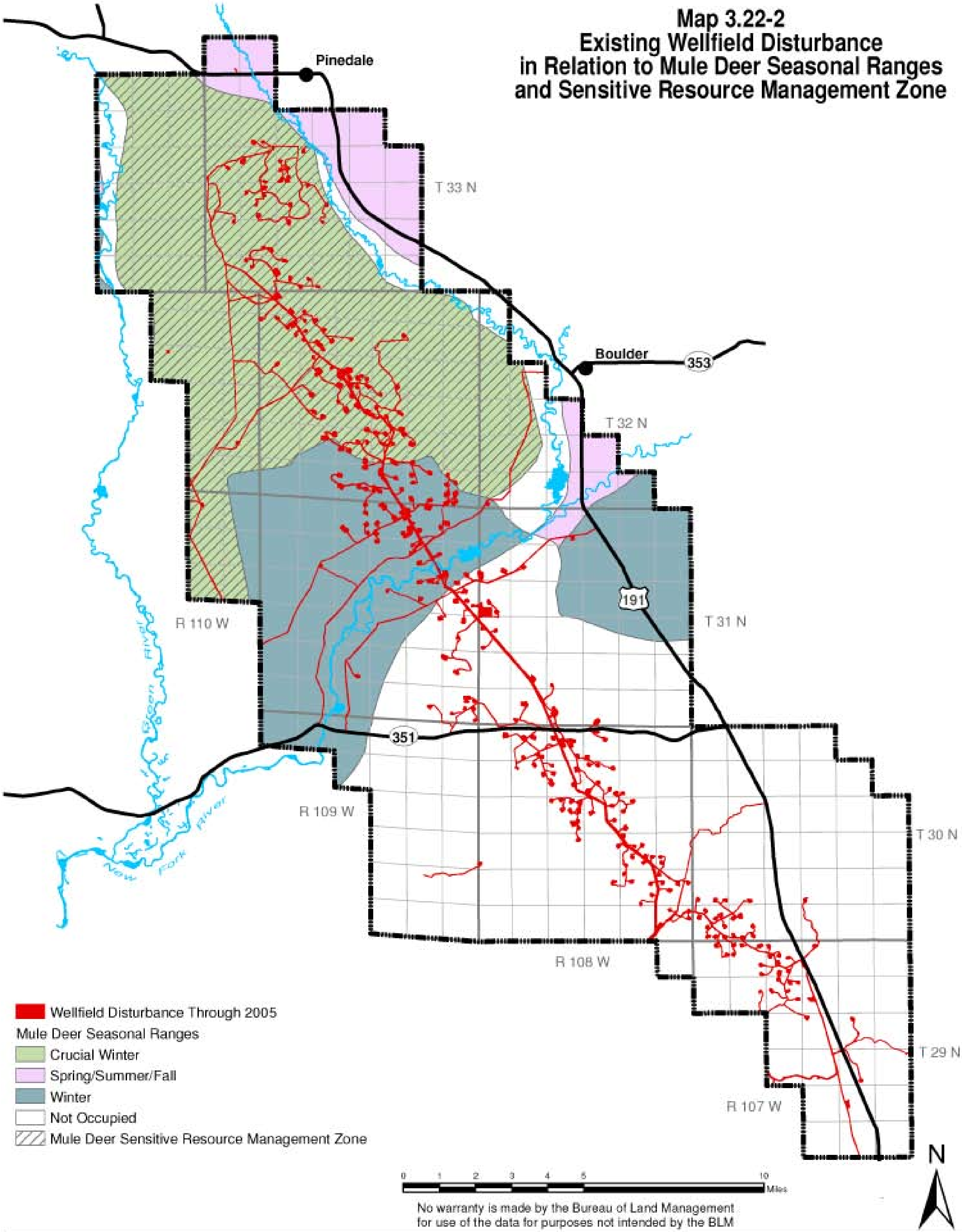
Table 3.22-3
Estimated Existing Wellfield Disturbance in Relation to Pronghorn Seasonal Ranges in the PAPA

Pronghorn Seasonal Ranges	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Crucial Winter Range and Pronghorn SRMZ	47,590	1,483.4	135.5	1,618.9	3.4
Spring/Summer/Fall Range	150,324	3,195.1	245.4	3,440.5	2.3
Winter Range	120	0.0	0.0	0.0	0.0
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

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

Map 3.22-2 Existing Wellfield Disturbance in Relation to Mule Deer Seasonal Ranges and Sensitive Resource Management Zone



their summer range in late March or early April, depending on weather conditions (Sawyer and Lindzey, 2001).

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, 2005a) 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. Productivity declined from 2003 to 2005 (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

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

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 K). 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 2 consecutive years of below-average precipitation (including winter snowfall), 3 consecutive years in 2002, and 4 years of drought in 2003. That trend of low precipitation continued at least through water year 2003.

Over-winter mortality of fawn and adult mule deer in the Sublette Herd Unit has been estimated since 1993 (Wildlife Technical Report, Appendix K). 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 K). Adult mule deer over-winter survival has been consistently above 80 percent survival since that 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 previous two years' growing seasons strongly influence fawn over-winter mortality by ameliorating or exacerbating the influence of winter snowfall (Wildlife Technical Report, Appendix K). 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 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, fawn mortality in the herd unit was significantly greater than predicted by the relationship of snowfall, precipitation, and temperature observed from winter 1993-1994 through winter 2004-2005. Mortality of fawns on winter ranges along the Pinedale Front was significantly greater than mortality of fawns on winter ranges in the Mesa Complex during 2005-2006, the first year with such a significant difference. Although climatological data do not indicate that winter conditions were more severe on the Pinedale Front 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 K).

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, 2004d and Carpenter, 2006a). Generally, the proportion of mule deer fawns killed by vehicles is greater than the proportion of fawns in the Sublette Herd Unit. Numbers of mule deer killed by vehicles along U.S. Highway 191 and State Highway 351, reported by WDOT from 1999 through 2005 (Carpenter, 2006a), do not appear to be related to traffic volume on either highway.

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, 2006). No such trend was observed on crucial winter ranges unaffected by natural gas developments that were used as a control in the study (Pinedale Front Complex). 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 minimal recruitment of other 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. 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.

Most 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. Most of the surface disturbance associated with wellfield development is within crucial winter range. There were more than 2,000 acres disturbed by wellfield development within mule deer seasonal habitats by the end of December 2005. An additional 229 acres are projected to be disturbed by the end of 2006, a relatively large proportion of which (146 acres) would be within crucial winter range (Table 3.22-5).

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

Mule Deer Seasonal Ranges	Surface Area in the PAPA (acres)	Surface Disturbance through 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Crucial Winter Range and Mule Deer SRMZ	54,242	1,372.5	146.3	1,518.8	2.8
Spring/Summer/Fall Range	10,396	59.6	0.0	59.6	0.6
Winter Range	35,248	929.6	82.0	1,011.6	2.9
Winter/Yearlong Range	7,320	27.2	0.5	27.7	0.4
Total	**107,206**	**2,388.9**	**228.8**	**2,617.7**	**2.4**

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, 2006a).

Since 2000, calf production in the Green River Herd Unit declined through 2002. Calf production increased in 2004, similarly 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, 2004a) 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

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

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, 2004a). 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.

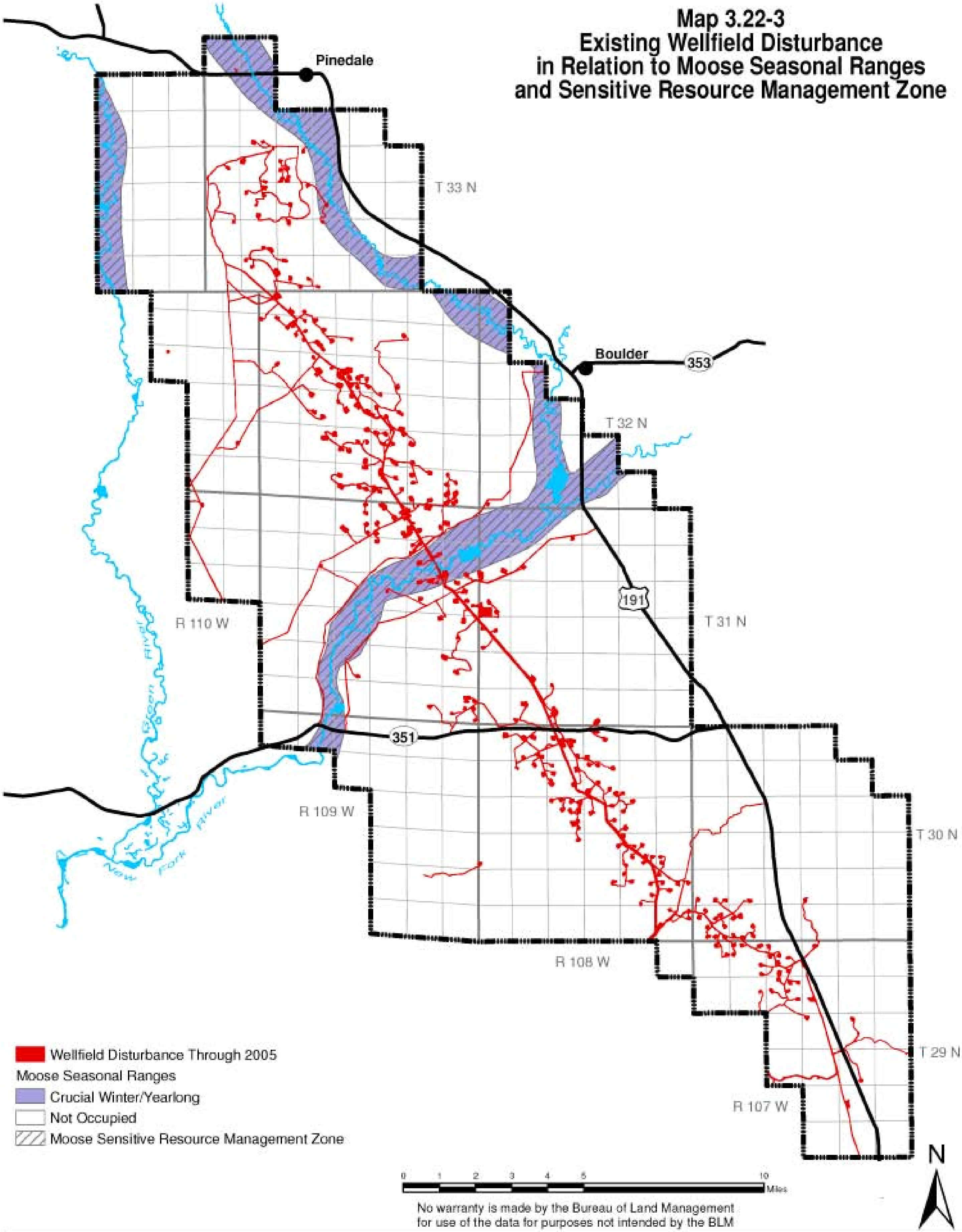
Moose. In the PAPA DEIS (BLM, 1999a), the Moose SRMZ coincided with crucial winter/yearlong moose habitat for the Sublette Herd Unit, found primarily within the riparian zone associated with the New Fork River (Map 3.22-3). Slightly more than 18,000 acres of moose crucial winter/yearlong have been defined within the PAPA. Of that habitat and as of December 2005, 228 acres were disturbed by wellfield development. An additional 24 acres of disturbance is projected for 2006, all within the Moose SRMZ.

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, 2006a).

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

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006


Map 3.22-3
Existing Wellfield Disturbance
in Relation to Moose Seasonal Ranges
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 2005
Moose Seasonal Ranges
Crucial Winter/Yearlong
Not Occupied
Moose 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

3.22.1.2 Upland Game Birds

Greater sage-grouse is the predominant upland game bird in southwestern Wyoming. In 2004, there were 19 active leks within the PAPA (Map 3.22-4). Two leks were abandoned by 2006. There are four additional leks within the PAPA that have been active within the past 10 years and eight leks that are within 2 miles of the PAPA boundary (Map 3.22-4). BLM (2004c) classifies all leks that have been active during at least one strutting season within the past 10 years as “occupied” and subject to the same protection as currently occupied leks.

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 bred (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 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 has 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 total number of greater sage-grouse harvested per recreation-day, which has significantly declined since 1982, suggesting declining greater sage-grouse (Figure 3.22-1). 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 in 2005, possibly reflecting increased survival following precipitation in 2004 and 2005 (see Table 3.3-1) as well as the effects of more conservative harvest management.

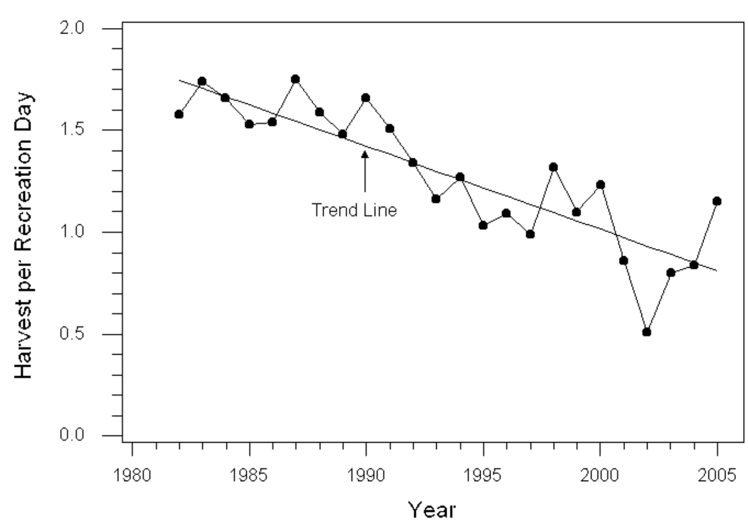
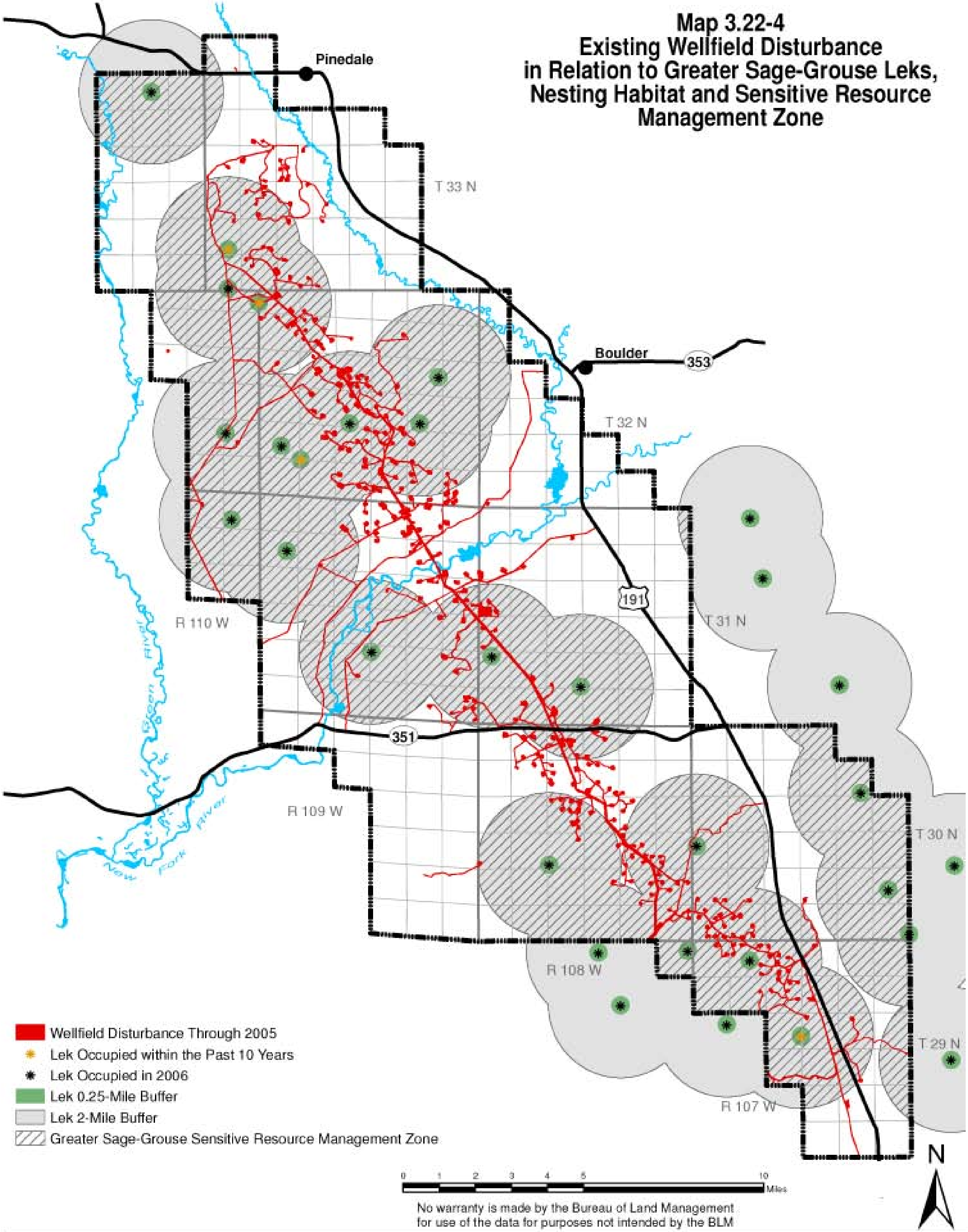


Figure 3.22-1
Greater Sage-Grouse Harvested per Recreation-Day in SUGMA 3 and 7 Combined, 1982 to 2005.
(Source: WGFD Annual Report of Upland Game and Furbearer Harvest 1983-2006)


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
Wellfield Disturbance Through 2005
Lek Occupied within the Past 10 Years
Lek Occupied in 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
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

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). Leks attended by male greater sage-grouse 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 1 year prior to well development through 2004 (Holloran, 2005). For example, on two leks within 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. Generally, there were fewer strutting males on leks closer to drilling rigs than on leks farther away from drilling.

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

Since 1999, varying numbers of leks on the Mesa, elsewhere within the PAPA, and within 2 miles of the PAPA have been monitored by personnel with BLM, WGFD, University of Wyoming, and other investigators. A trend emerged as increased numbers of leks were censused. Average male attendance at leks on the Mesa and in the PAPA declined from 2001 through 2004 although average male attendance at leks within 2 miles of the PAPA showed a different trend during the same period (Figure 3.22-2). Average male attendance did increase overall on the Mesa, in the PAPA, and off of the PAPA during 2005 and 2006, possibly due to increased juvenile survival with increased precipitation during 2004 (Figure 3.22-2). Two new leks, one on the Mesa (Lovatt West) and in the PAPA (Dukes Triangle), were found in 2005 and both were active in 2006. During 2006, there were no males observed at two leks on the Mesa (Mesa Springs and Lovatt Draw Reservoir) and, as noted earlier, both leks appear to have been abandoned.

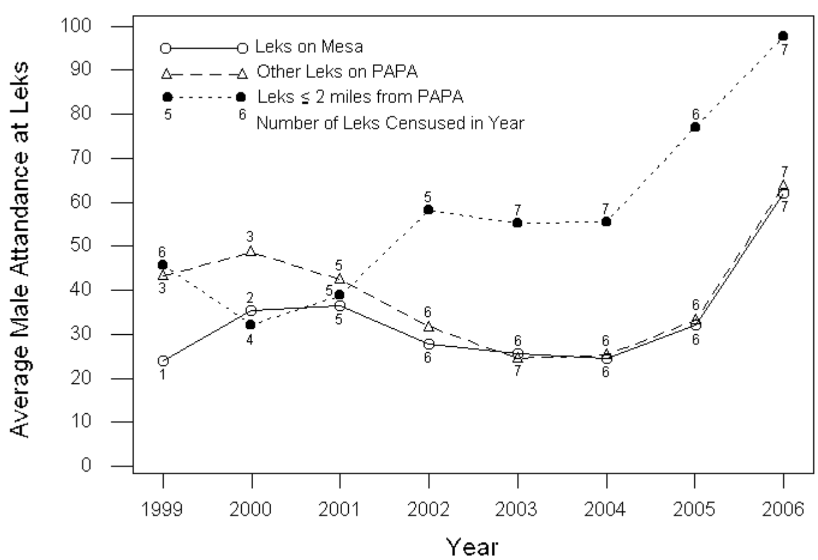


Figure 3.22-2
Greater Sage-Grouse Average Male Attendance at Leks Censused on the Mesa, in the PAPA, and within 2 miles of the PAPA since 1999
(Data from Holloran, 2005; Kaiser, 2006; and WGFD, 2006c).

Mature females are likely to reuse the same nest site. But 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. BLM (2004c) has recommended no disturbance or disruptive activities within greater sage-grouse winter habitat from November 15 through March 14, although wintering habitat in the PAPA has not yet been formally identified.

In the PAPA DEIS (BLM, 1999a), BLM utilized standard stipulations to define and manage important habitat for greater sage-grouse as the Sage Grouse SRMZ, which included all areas within 2 miles of each occupied lek (Map 3.22-4). Specific management components within the SRMZ include avoidance of surface activities or aboveground structures within 0.25 mile of each lek on federal lands and minerals. BLM (2004c) requires avoiding human activity within 0.25 mile of an occupied lek between 8 p.m. and 8 a.m. from March 1 through May 15. Further, BLM requires limiting surface disturbing activities within 2 miles of each lek between March 15 and July 15 to avoid disturbing greater sage-grouse courtship displays on leks and grouse nesting within the 2-mile radius.

WGFD documented locations of 12 leks within the PAPA north of the New Fork River, including the Lovatt West lek (new in 2005), and three occupied leks that were active in the past 10 years. Eleven leks were documented within the PAPA south of the New Fork River, including the Dukes Triangle lek that apparently was first attended by males in 2005 and one other occupied lek that was active in the past 10 years. There are occupied leks within 2 miles of the PAPA border. There are 113,325 acres included in the Sage Grouse SRMZ (Table 3.22-8) which are associated with the 2-mile buffers of all occupied leks.

As of December 2005, there was approximately 42 acres of disturbance within the 0.25-mile buffer for greater sage-grouse leks. There was nearly 3,200 acres of disturbance within the 2-mile buffer and Sage Grouse SRMZ (Table 3.22-8).

Table 3.22-8
Estimated Existing Wellfield
Disturbance to Sage Grouse Lek Buffers in the PAPA

Lek Buffer	Surface Area in the PAPA (acres)	Surface Disturbance through 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
0.25-Mile Buffer	2,831	41.7	2.2	3.9	1.6
2-Mile Buffer and Sage Grouse SRMZ	113,325	3,198.0	249.5	3,447.5	3.0

In 2006, slightly more than 2 acres could potentially be disturbed within the 0.25-mile buffer, but an additional 250 acres of disturbance is projected within 2-mile buffers surrounding leks in the PAPA (the Sage Grouse SRMZ) in 2006 (Table 3.22-8).

Mourning doves are upland game birds potentially harvested in the PAPA, though not to the extent of sage grouse. Ruffed grouse and chuckar may also be hunted in or near the PAPA (Table 3.22-9).

Table 3.22-9
Harvest Data For Other Upland Game Birds
and Derived Statistics in SUGMA 3 and 7 During 2005

Game Bird	SUGMA	Hunters	Hunter Days	Harvest	Days per Hunter	Days per Harvest	Harvest per Day
Mourning Dove	3 - Bridger	11	57	114	5.0	0.5	2.0
Zenaida macroura	7 - Eden	41	82	218	2.0	0.4	2.7
Ruffed Grouse	3 - Bridger	181	860	331	4.7	2.6	0.4
Bonasa umbellus	7 - Eden	17	83	15	5.0	5.6	0.2
Chuckar *Alectoris chuckar*	3 - Bridger	3	5	3	2.0	2.0	0.5
Source: WGFD, 2006d.							

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; Chapman et al., 1982). Cottontails harvested per recreational-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.

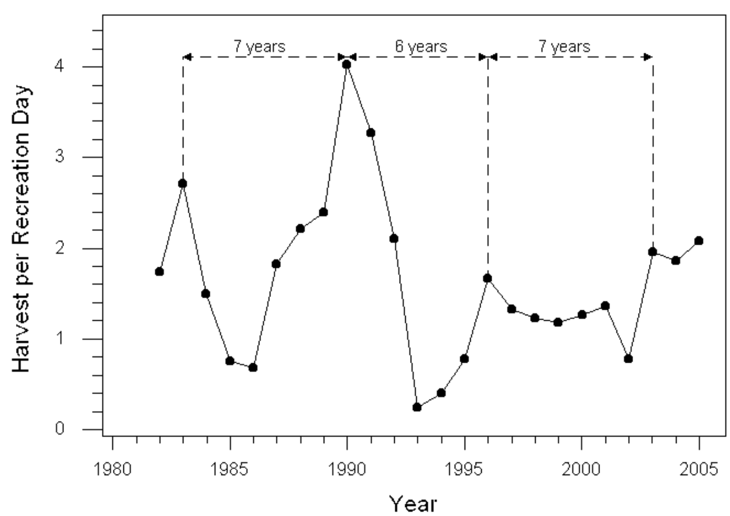


Figure 3.22-3
Cottontail Rabbits Harvested per Recreation-Day
in SUGMA 3 and 7 Combined, 1982 to 2005.

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., 2005). Of those, 107 species are listed as Nearctic-Neotropical migratory birds by the FWS, 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 23 migratory species in the region allowed estimation of trends from 1994 through 2003, reported by the BLM (2004a). With only nine routes in the region, there were only 23 migratory species with barely adequate data to estimate trends over the past 10 years (1994-2003). Those species and their apparent recent trends (past 2 to 3 years) are listed in Table 3.22-10. In 2004, only two of the nine routes were surveyed, an inadequate sample to include in further analysis.

Trends of abundances for six migratory species appear to be declining; of these, four species (killdeer, common nighthawk, rock wren, and sage thrasher) nest on or close to the ground in a variety of habitats. Three declining species inhabit wetland and/or riparian habitats (killdeer, yellow warbler and red-winged blackbird). The abundance of other species that utilize riparian or other moist habitats appear to be increasing (tree swallow, bank swallow, barn swallow, and song sparrow), although those species nest above ground level. Other species that appear to be increasing include western meadowlark, Brewer's blackbird, and brown-headed cowbird; the latter two species have some affinity for human-altered habitats, and western meadowlarks are often associated with agriculture (Cerovski et al., 2004).

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. Although the common raven occurs in the PAPA, is a potential predator and/or scavenger, and classified as a raptor by some, it is within 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).

Table 3.22-10
Common Neotropical Migratory Birds in the Vicinity of the PAPA with Recent Trends Estimated from National Biological Survey Breeding Bird Survey Data from 1994 to 2003

Common Name Scientific Name	Nest Substrate[1]	General Habitat[1]	Recent Trend
American Kestrel *Falco sparverius*	Tree cavity, abandoned nest	All habitats	No trend
Killdeer *Charadrius vociferus*	Ground	Shoreline, aquatic sites in most habitats	Decreasing
Mourning Dove *Zenaida macroura*	Tree, ground, abandoned nest	All habitats	No trend
Common Nighthawk *Chordeiles minor*	On ground	Open, semi-open habitats, agriculture	Decreasing

Common Name Scientific Name	Nest Substrate[1]	General Habitat[1]	Recent Trend
Horned Lark *Eremophila alpestris*	On ground	Shrubland, grassland	No trend
Tree Swallow *Tachycineta bicolor*	Tree cavity, other cavities	Riparian cottonwood, aspen with cavity trees	Increasing
Violet-green Swallow *Tachycineta thalassina*	Tree cavity, other cavities	Aquatic habitats with cavity trees	No trend
Bank Swallow *Riparia riparia*	Burrow in bank or cliff	Aquatic habitats with cavity banks, cliffs	Increasing
Cliff Swallow *Petrochelidon pyrrhonota*	Attached to natural, man-made structure	Aquatic habitats with substrate for nest	No trend
Barn Swallow *Hirundo rustica*	Attached to natural, man-made structure	Near aquatic habitats with substrate for nest	Increasing
Rock Wren *Salpinctes obsoletus*	In cavity or crevice	Rock outcrops/piles in shrubland, grassland	Decreasing
Mountain Bluebird Sialia currucoides	In cavity in snag	Most habitats with nest cavity tree, snag	No trend
American Robin *Turdus migratorius*	In deciduous or coniferous tree	All habitats with trees, shrubs	No trend
Sage Thrasher *Oreoscoptes montanus*	In or beneath sagebrush shrub	Sagebrush shrubland	Decreasing
Yellow Warbler *Dendroica petechia*	In shrub or small deciduous tree	Riparian shrub, trees	Decreasing
Brewer's Sparrow *Spizella Breweri*	In shrub	Sagebrush shrubland	No trend
Vesper Sparrow *Pooecetes gramineus*	On ground	Shrubland, grassland, agriculture	No trend
Sage Sparrow *Amphispiza belli*	In or beneath sagebrush shrub	Sagebrush shrubland	No trend
Song Sparrow *Melospiza melodia*	In grass clump or in a shrub	Riparian cottonwood, shrub, marsh	Increasing
Red-winged Blackbird *Agelaius phoeniceus*	On emergent vegetation	Riparian shrub, marsh, agriculture	Decreasing
Western Meadowlark *Sturnella neglecta*	On ground	Shrubland, grassland, agriculture	Increasing
Brewer's Blackbird *Euphagus cyanocephalus*	Tree or shrub just above ground	Deciduous forest, shrub, grass, urban	Increasing
Brown-headed Cowbird *Molothrus ater*	Parasitizes nests of other birds	Riparian cottonwood, shrub, agriculture, urban	Increasing

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

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.

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 those investigations have been summarized in WGFD's Annual Fisheries Progress Reports, Jackson/Pinedale Region.

Sampling to estimate populations of game fish in the various river segments has been conducted in some years (Table 3.22-11). Though sample sizes for some species have been too small to allow population estimates, the values in Table 3.22-11 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 3.22.11
Population Estimates of Game Fish Species in
River Segments of the Green River and New Fork River Proximate to the PAPA

River Segment	Common Name Scientific Name	Estimate of Fish > 6 inches per mile in River Segment [1]			
		2001	**2002**	**2003**	**2004**
Green River Downstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	18	24	Ns	ns
	Brown Trout *Salmo trutta*	197	616	Ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	22	11	Ns	ns
Green River Upstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	ns	ss (1)	-
	Brown Trout *Salmo trutta*	ns	ns	ss (150)	349
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	ns	ss (8)	164
	Mountain Whitefish *Prosopium williamsoni*	ns	ns	928	-
	Brook Trout *Salvelinus fontinalis*	ns	ns	-	12
New Fork River Downstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ss (2)	ns	Ns	ns
	Brown Trout *Salmo trutta*	302	ns	Ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	5	ns	Ns	ns
	Kokanee Salmon *Oncorhunchus nerka*	ss (≥3)	ns	Ns	ns
	Lake Trout *Salvelinus namaycush*	ss (1)	ns	Ns	ns
New Fork River Upstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	2	≈3	ns
	Brown Trout *Salmo trutta*	ns	507	973	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	16	≈71	ns
	Kokanee Salmon *Oncorhunchus nerka*	ns	-	≈6	ns

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

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 3.22-11). 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 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.

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, 2006e). 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 3.22-12). Though native to Wyoming, white suckers are not native to the Green River drainage and have hybridized with native flannelmouth suckers. Indeed, hybridization by non-native species is one threat to native species in the Green River drainage.

Table 3.22-12
Native, Non-Game Fish Documented in
River Segments of the Green River Proximate to the PAPA.

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
Source: WGFD, 2003c, and 2004e.		

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, 2003b). 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 in 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 corridors are not known to support populations of elk and moose, although, individuals are infrequently observed in the vicinity of the proposed corridors (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 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, 1991a). 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. Those substances and their current management protocol are discussed in detail in the Hazardous Materials Management Summary (Appendix C).