

CHAPTER FIVE CUMULATIVE IMPACTS

5.1 Introduction

Cumulative impacts are defined as those that result from "*the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*" (see 40 CFR Part 1508.7). Potential cumulative impacts generated as a result of continued exploration and development of the Pinedale Anticline are described for each potentially affected resource within a cumulative impact analysis area (CIAA). These CIAAs have been defined by BLM and the cooperating agencies for each resource with public involvement. The CIAAs cover different geographic areas depending on the specific resource being evaluated. Evaluation of potential impacts takes into consideration incremental impacts that may occur from the proposed project while also considering impacts from past, present and reasonably foreseeable development (RFD) within each of the CIAAs. RFD are those future action activities that have been committed to or that are known proposals which could take place within the next 10 to 15 years within each CIAA.

Cumulative Impact Analysis Areas. The CIAAs were developed with input from the public and other regulatory agencies during scoping and are mapped and described in each resource section below. The analysis areas are based on natural boundaries defined by the resource (i.e., herd units, watersheds, etc.) and the potential for cumulative impacts to occur. CIAAs are larger for resources that are mobile or migrate compared to resources that are stationary. For example, the CIAA for big game is based on herd unit boundaries which contain habitats that support individual herds year-round. The air quality CIAA is extremely large because it is based on the complex interaction between climatic factors, terrain and the potential for significant impacts to occur in sensitive areas within the airshed. Smaller CIAAs, which generally encompass the PAPA and a relatively small buffer, were established for resources that are immobile or stationary such as vegetation, visual and cultural resources.

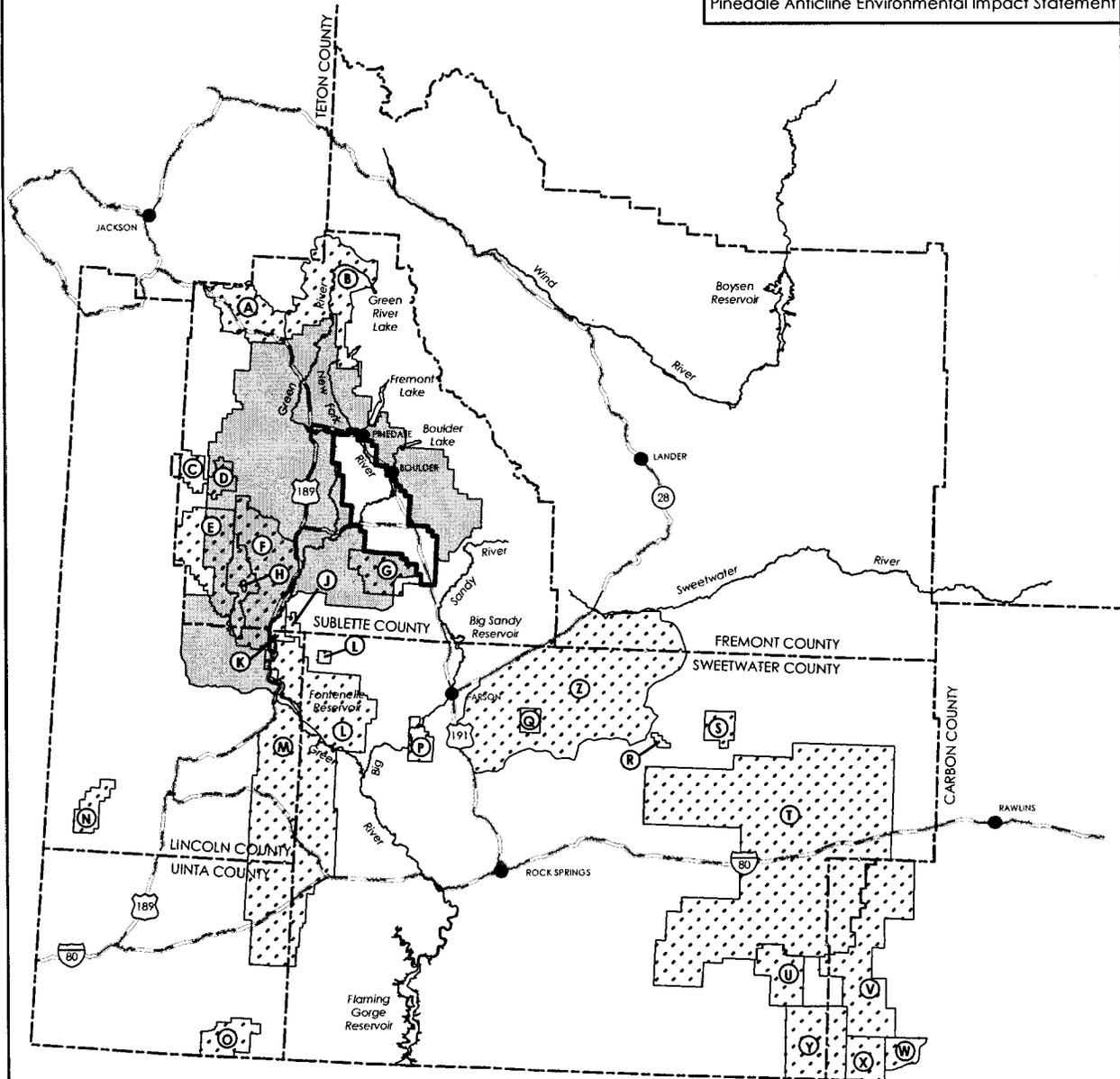
Existing Oil and Gas Development. The level and extent of existing oil and gas activity in the CIAAs was determined using information provided by the BLM's Reservoir Management Group, Casper Field Office. The location of all active and inactive (i.e., shut-in, temporarily abandoned and plugged and abandoned) wells and injection wells in southwestern Wyoming (i.e., Sublette, Lincoln, Sweetwater, Uinta, Carbon and Fremont counties) were compiled. The six county area had a total of 8,010 active wells as of June, 1998. The well locations were incorporated into spatial analysis for each of the CIAAs. This allowed for determination of the existing level of oil and gas development in the various CIAAs. Table 5-1 provides a listing of the oil and gas projects in southwestern Wyoming that have been recently analyzed or are currently being analyzed in NEPA documents under the direction of the BLM or the USFS. Figure 5-1 shows the locations of these projects.

Reasonably Foreseeable Development. The last column in Table 5-1 lists the number of producing wells that could still be developed for each of the projects should development reach the ultimate level analyzed in the appropriate NEPA document for southwestern Wyoming. The potential exists for the development of another 7,711 new/replacement wells in southwestern Wyoming over the next 10 to 15 years from projects located on Federal, private and state blocked and checkerboard land and mineral ownership in Sweetwater, Lincoln, Uinta, Sublette, Fremont, and Carbon counties. If this were to occur, the number of currently active and inactive wells in southwestern Wyoming would nearly double. The total of 7,711 wells is a potential only, based on the NEPA approved totals. It is very unlikely that these projects would actually drill all the wells that are approved. In fact, some operators have already discussed the fact that they will not be drilling some of these wells in the future. However, it was decided that for this EIS, the NEPA approved total RFD would not be reduced based on conversations with other operators. This could, in effect, limit their ability to drill all the wells and therefore, they are all included in the RFD. In addition, according to the Green River RMP and Final Environmental Impact Statement (BLM, 1996c), many existing wells will cease to produce based on historic records, and over 70 percent of existing wells will be plugged and abandoned by year 2010. It is anticipated that these

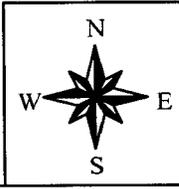
Figure 5-1

NEPA Analysis of Existing and Potential Oil and Gas Projects in Southwest Wyoming

Pinedale Anticline Environmental Impact Statement



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|---------------------------------|---------------------------------|
| Pinedale Anticline Project Area | Road Hollow |
| Pinedale Resource Area | Hickey Mountain |
| Hoback Basin (MA 21) | Stagecoach Draw |
| Upper Green River (MA 72) | Essex Mountain |
| Soda Unit | Bravo |
| Castle Creek Unit | Hay Reservoir |
| Riley Ridge | Continental Divide/Wamsutter II |
| CAP | Mulligan Draw |
| Jonah II | Creston/Blue Gap |
| Burley | Sierra Madre |
| Bird Canyon | South Baggs |
| East LaBarge | Dripping Rock/Cedar Breaks |
| Fontenelle Reservoir | Jack Morrow Hills |
| Moxa Arch | |



**Table 5-1
Summary of Oil and Gas Development Projects Previously or Currently Being Analyzed
Under NEPA in Southwestern Wyoming**

Project	Date ROD Signed	Number of Wells Existing When EIS Was Written	Number of Wells Allowed by ROD	Number of Wells Drilled Since ROD (2)	Dry Hole, Depleted or Plugged & Abandoned (2)	Completed but not Producing (2)	Producing Wells (2)	Remaining Wells that can Still Be Drilled (RFD) (1)
Riley Ridge	1/25/84	10	238	19	5	1	23	224
Burley	6/7/94	15	32	19	3	0	31	16
Jonah II Field	4/27/98	88	450	41	0	0	129	321
Coordinated Activity Plan Area	8/16/91	1,080	500	409	354	0	1,135	445
Soda Unit	4/12/89	4	17	0	1	0	3	18
Castle Creek	10/24/83	2	16	6	0	0	8	10
Moxa Arch	3/7/97	849	1,325	163	62	0	947	1,227
Hickey Mountain	5/13/87	16	70	19	9	10	26	50
Road Hollow	9/83	1	9	8	5	0	4	6
Fontenelle	8/16/96	907	1,292	151	6	6	1,052	1,141
Stagecoach	9/27/95	5	72	8	1	9	9	59
East LaBarge	5/29/92	83	28	19	1	83	19	9
Bird Canyon	6/25/93	6	14	6	0	6	6	8
Essex Mountain	8/4/95	0	3	0	0	0	0	3
Bravo Unit	7/20/95	3	10	6	1	2	7	4
Mulligan Draw	9/23/92	11	40	12	3	11	17	23
Creston Blue Gap	10/4/94	202	200	100	3	7	234	175
Dripping Rock/Cedar Break	4/3/85	11	58	20	2	11	24	34
Sierra Madre	9/21/87	16	46	27	2	16	30	16
Hay Reservoir	6/24/92	36	26	20	2	20	40	2
Jack Morrow Hills	Pending	66	110 (4)	N/A	14	20	46	110
Continental Divide/Greater Wamsutter	Pending	845	3,000 (4)	N/A	6	214	651	3,000
Pinedale Anticline	Pending	41	700 (3)(4)	N/A	11	8	22	700
South Baggs	Pending	17	90 (4)	N/A	13	1	16	90
Upper Green River - USFS MA 72	Pending	23	17 (4)	N/A	23	0	0	10
Hoback Basin - USFS MA 21	Pending	8	87 (4)	N/A	8	0	0	10
Total		4,345	4,446 (5)	1,053				7,711

1 = Reasonably foreseeable development that could take place within the next 10 to 15 years within southwestern Wyoming.

2 = As of 12/98

3 = 700 pads - not wells

4 = No ROD available - pending completing of EIS's

5 = Total wells allowed for approved RODs. Total wells allowed including pending RODs is 8,450.

will be replaced by new wells. Given this projection on wells to be plugged, the number of wells in southwestern Wyoming certainly would not "double".

Within the Pinedale Field Office Area and on adjacent USFS lands (hereafter referred to as the Pinedale RMP Area, see Figure 5-2), reasonably foreseeable development for existing and future projects is 1,944 wells which could be drilled in the next 10 to 15 years. It includes remaining wells to be drilled in existing projects with NEPA approval (Riley Ridge, Burley, Jonah II, Big Piney-LaBarge CAP, Soda Unit and Castle Creek). It also includes 700 future producing wells in the PAPA, 20 wells in the Bridger-Teton National Forest (MAs 21 and 72) and 200 additional wells that could be drilled anywhere in the RMP area on Federal, state or private lands and minerals.

Reasonably foreseeable development on the Bridger-Teton National Forest in areas adjacent to the Pinedale Field Area would occur in Management Areas (MA) 21 (Hoback Basin) and 72 (Upper Green River) (see Figure 5-1). BLM (1998d) estimates that 10 wells could be drilled in each of these two MAs (assuming the USFS allows access and leasing within the MAs) in the next 10 to 15 years. According to BLM (1998d), the MAs are high-risk exploratory plays. Since 1947, 31 wells have been drilled within the MAs and 15 additional wells have been drilled just outside their borders. Drilling has confirmed the occurrence of natural gas at Game Hill, Black Butte and Willow Lake units which are areas either within or immediately adjacent to MAs 21 and 72. To date, none of the gas discoveries have been economical to develop. Gas flow volumes have been too small and the locations too remote to justify putting the wells into production and constructing a pipeline to connect the wells with markets. For the most part, exploratory drilling within or near these MAs has occurred during boom periods of the petroleum industry when oil and gas prices were high and higher risk was acceptable.

Table 5-2 provides a list of the oil and gas development projects in the Pinedale RMP area. The RFD analyzed in the BLM's 1988 Pinedale RMP was estimated at 900 wells. This development estimate would be exceeded before the 700 producing well pads analyzed in this EIS are developed. Therefore, this EIS provides the analysis to update the RFD for oil and gas development for the Pinedale RMP. Reasonably foreseeable development over the next 10 to 15 years in the RMP area is projected to be

1,944 new and/or replacement producing oil and gas wells.

5.2 Withholding Federal Minerals From Leasing

The BLM Pinedale Field Office recommended to the BLM State Director that all currently unleased areas and expired leases on Federal lands and minerals in the PAPA be withheld from oil and gas leasing until this EIS is complete (BLM, 1999). Withholding these leases would allow the opportunity to apply mitigation developed through this EIS to new leases. The field office also recommended that all unleased public lands and minerals in the Hoback Basin and along the Wind River Front and southern foothills of the Gros Ventre Range be withheld from oil and gas leasing until the effects of leasing these lands can be addressed in a revision to the 1988 BLM Pinedale RMP and the Bridger-Teton Leasing EIS. This recommendation also applies to lands where leases have expired, as well as to leases that will expire in the future. The areas for which BLM has recommended that leases be withheld are shown on Figure 5-2. The BLM State Director has concurred in the above recommendations and all unleased Federal mineral estate within the described areas shown on Figure 5-2 are withheld as specified above.

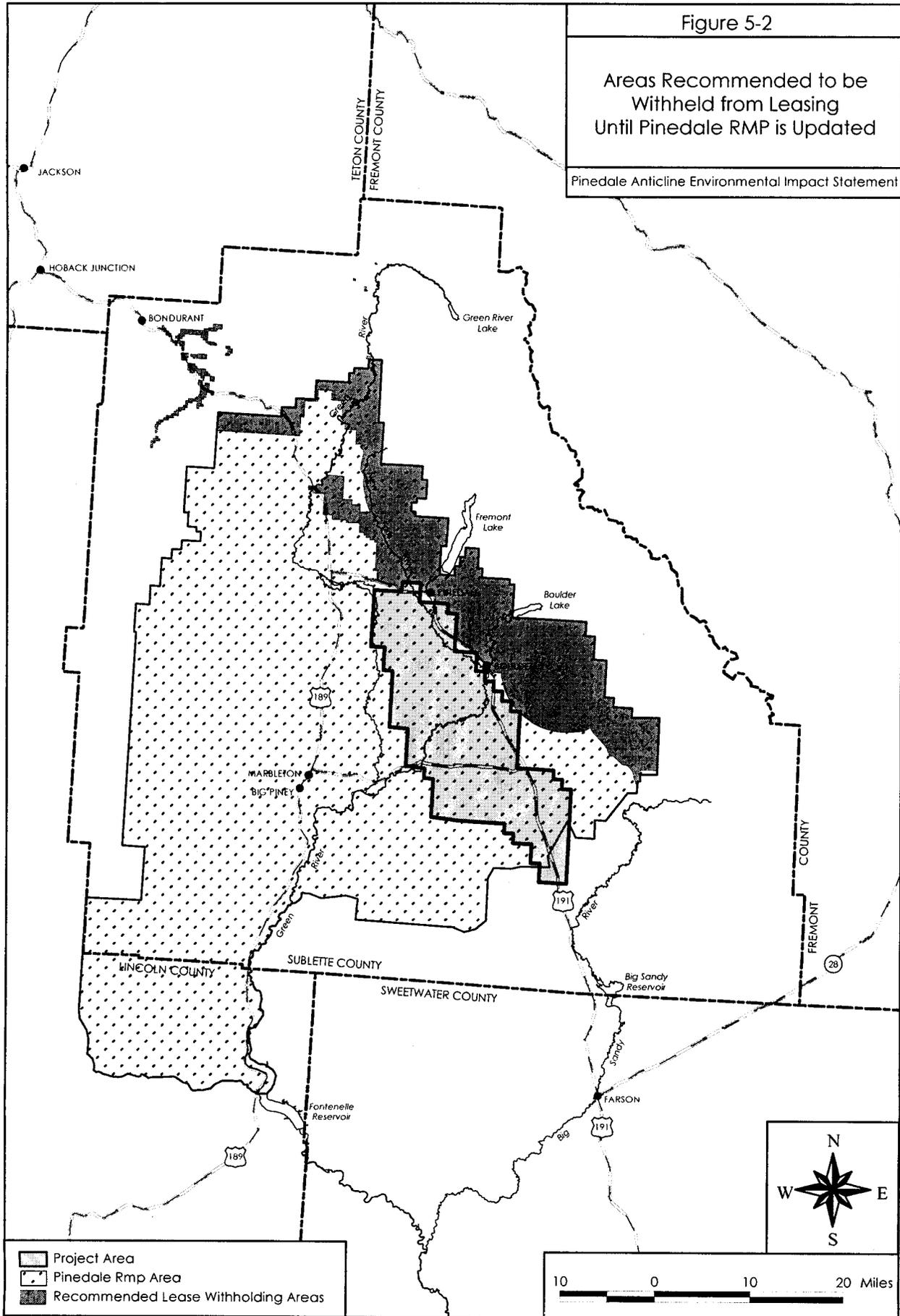
The Wind River Front and Gros Ventre foothills are areas where concerns have developed since the approval of the Pinedale RMP in 1988. These concerns include protection of Air Quality Related Values associated with Class I airsheds in the region (Bridger and Fitzpatrick wilderness areas), protection of the scenic values of the mountain ranges, and protection of the new and/or more densely populated rural subdivisions occurring on private surface underlain by Federal minerals. They also include concerns regarding noise protection for the U.S. Air Force Seismic Monitoring Installation east of Boulder, Wyoming, and the possible expansion of the Wind River Front Special Recreation Management Area developed in the Green River RMP.

Air quality has recently become an issue in oil and gas development projects throughout the Green River Basin. Projects such as Moxa Arch, Stagecoach and Fontenelle are relatively distant from Class I airsheds and yet, air quality is still a concern. The Wind River Front and Gros Ventre foothills are immediately adjacent to the Class I airsheds.

Figure 5-2

Areas Recommended to be Withheld from Leasing Until Pinedale RMP is Updated

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**Table 5-2
BLM Pinedale Field Office Area and Adjacent USFS Lands
Reasonably Foreseeable Oil and Gas Development Projections**

Project	Status of NEPA Analysis	Reasonably Foreseeable Development Number of Wells
Riley Ridge	ROD 1/25/84	224
Burley	ROD 6/7/94	16
Jonah II Field	ROD 4/27/98	321
Big Piney-LaBarge Coordinated Activity Plan	ROD 8/16/91	445
Soda Unit	ROD 4/12/89	18
Castle Creek	ROD 10/24/83	0
Pinedale Anticline	EIS in preparation	700 (1)
Upper Green River and Hoback (USFS MA 72 and 21)	No NEPA analysis	20
Other projects	No NEPA analysis	200
Total		1,944

(1) Pads - not wells

Visual resource management of Federal landscapes is an issue that was addressed in the Pinedale RMP. However, it has received new interest with the proposed development near Pinedale. Much of the Wind River Front and Gros Ventre foothills have already been classified as VRM Class II, but on-the-ground VRM management in these and other visually-sensitive areas needs to be re-evaluated. The current VRM classifications are over 10 years old and need to be updated to reflect changing development patterns and recreational needs of the residents within the field area.

Rural subdivisions were not addressed in the 1988 Pinedale RMP, yet they are increasing in parts of Sublette County. New subdivisions have been developed and dwelling densities have increased in others. Sublette County has now developed zoning that addresses and identifies areas suitable for residential development. Many of the residential areas, including subdivisions, overlay Federal minerals. With the current and proposed future dwelling density, it may not be possible to maintain the 0.25 mile buffer which is unilaterally applied to oil and gas leases through Lease Notice # 1.

The U.S. Air Force Seismic Monitoring Station (Detachment 489) located east of Boulder, Wyoming, along the Wind River Front was closed prior to completion of the Pinedale RMP. It reopened after

the RMP was completed and therefore, seismic and drilling operations that could increase ground noise in the vicinity of the Air Force installation were not addressed. The purpose of the Air Force site is to monitor nuclear testing throughout the world and to test equipment that will be deployed to other monitoring sites. In 1990, the Air Force requested a 10-mile drilling and geophysical exploration buffer. The buffer was reaffirmed during the public scoping process for this EIS, however, the Air Force reevaluated the buffer and have now recommended that the buffer be 6 miles.

The Green River RMP, approved in 1997, established the Wind River Front Special Recreation Management Area (SRMA) which includes an area closed to oil and gas leasing. The RMP places significant restrictions on development in those areas available for lease within the SRMA. Resource values justifying the "no lease area" include recreational activities/opportunities, established recreational facilities (campgrounds, snowmobile trails), historic sites and trails, quality and quantity of fishable streams, and crucial wildlife habitat. The SRMA currently ends at the Rock Springs and Pinedale Field Office boundary. However, the resource values identified in the Green River RMP that justified development of the SRMA do not stop at the boundary. They continue north along the Wind River Front through the RMP area. To prevent significant impacts from occurring, and limiting the choice of reasonable alternatives, leasing in this area would be re-evaluated.

Another issue that should be addressed during initial oil and gas leasing is the way that Federal leases are issued in the Pinedale RMP Area. A number of small, disjunct and isolated leases are being issued. Figure 4-2 shows examples of these non-contiguous leases in the PAPA. When leases are issued in this manner, the field office's ability to manage for other resource values may be limited. BLM must allow access to each of the lease parcels which may result in unnecessary development to hold a lease. It would be prudent for BLM to review how it issues leases in the RMP area and evaluate ways to configure leases that do not compromise the ability to manage for impacts on-the-ground.

5.3 Socioeconomic Resources

In 1997, the University of Wyoming completed an economic evaluation of southwestern Wyoming (University of Wyoming, 1997). The study focused on

activities in which the BLM has management responsibilities, including oil and gas development. That report clearly demonstrates the dominant role that mineral development, particularly natural gas, plays in the economy of southwestern Wyoming. The report is an important source of information for anyone interested in further understanding of the regional economic role of oil and gas.

The CIAA for socioeconomics is Sublette County (including Pinedale, Marbleton, Big Piney), Sweetwater County (Rock Springs and Green River), Lincoln County (Kemmerer), and Uinta County (Evanston). All of these counties and surrounding communities depend on the oil and gas industry for a significant portion of their economic activity (University of Wyoming, 1997).

There are 7,711 new/replacement wells that could be drilled within the socioeconomic resource CIAA in the next 10 to 15 years (this number includes Carbon County). It is not anticipated that there would be any significant cumulative negative socioeconomic impacts within the CIAA. Infrastructure and facilities and services are available to support the projected cumulative level of drilling in the CIAA. However, additional oil and gas development in southwestern Wyoming would continue to provide a significant positive economic benefit within the five county area and their communities.

Revenues. Potential tax and royalty revenues to Sublette County and its communities from the Pinedale Anticline Project are expected to have a significant positive impact as discussed in Section 4.4.3. However, the existing tax base discussed in Chapter 3 did not include 1998 revenues from the Jonah II Field. According to Smith (1998), the 1998 royalties and taxes generated by the Jonah II Field may be higher than the total of the three previous years, combined. Cumulative impacts to Sublette County revenues and to the State of Wyoming and Federal government are anticipated to be beneficially significant.

Housing Demand. It is anticipated that most of the workforce associated with the Pinedale Anticline Project would be based out of Rock Springs, Big Piney and Marbleton (where well service companies are based). It is important to recognize that the type of workforce associated with the Pinedale Anticline Project would be essentially the same type of workforce used to develop the Jonah II Field. Drilling rigs and well completion crews would be expected to

work in both areas. Housing demand is expected to concentrate in Rock Springs where most of the service companies are located and where an adequate supply is available. No cumulative adverse impact to housing supply in the CIAA is anticipated.

Demand for Services and Facilities. Generally, services and facilities such as schools, rural fire departments, emergency medical services, and law enforcement are provided on a county-wide basis. Demands for additional facilities and services from the Jonah II Field have already been absorbed by Sublette County and the school district. Therefore, no cumulative impact is projected for demands on services and facilities. However, the affects addressed in Section 4.4.3 would still need to be addressed by the operators.

Table 5-2 shows that as many as 1,944 additional wells could be drilled in the Pinedale RMP area during the next 10 to 15 years. However, it is important to recognize that the majority of these wells are associated with the Jonah II Field, Big Piney-La Barge Coordinated Activity Plan (CAP) Area and the Pinedale Anticline Project Area. The impacts of these projects have been discussed in a number of NEPA documents and the RMP area can absorb the demands that these projects would place on housing, facilities and services. The impacts associated with the projected 200 wells that may be drilled somewhere in the Pinedale RMP area outside of these known project areas would be insignificant and very temporary in nature. The revised oil and gas RFD is not anticipated to result in any significant adverse impacts to socioeconomic resources in the RMP area. The RFD will, however, continue to provide significant revenues to local governments within the RMP area.

5.4 Transportation

The CIAA for transportation includes U.S. Highway 191 from Rock Springs to Daniel, U.S. Highway 189 from Marbleton/Big Piney to Daniel and State Highway 351 between U.S. Highways 189 and 191. All county and BLM roads in the PAPA are also included in the CIAA. Most of the cumulative impacts to transportation would be from the Jonah II Field, and recreational and other traffic associated with the listed roadways. The Jonah II Field is a large gas development project with a substantial amount of drilling activity currently ongoing. Development of the Jonah II Field is expected to progress concurrently with development of the Pinedale Anticline. Although

activity associated with the Jonah II Field was already occurring during 1998, the existing traffic levels described in Section 3.6 of this EIS were for 1997 and did not take into account the Jonah II Field traffic which was greater in 1998. It is likely that the 1998 level of traffic for the Jonah II Field would continue in future years until the field is completely developed. There are still, as of January 1999, 321 existing wells which could be developed in the Jonah II Field.

U.S. Highway 191 would experience most of the cumulative traffic because traffic from both projects would travel this road simultaneously. The largest impact to the traffic levels on U.S. Highway 191 would be south of the Luman Road where most of the Jonah II Field traffic is likely to exit the highway. The Pinedale Anticline traffic would continue traveling north and exit on State Highway 351 or elsewhere on U.S. Highway 191. Although not addressed in the Jonah II Field EIS (BLM, 1997a), project traffic on U.S. Highway 191 could equal the peak traffic projected for the Pinedale Anticline Project. Combined, peak cumulative traffic levels could reach or exceed 1,000 one-way trips per day. This peak level of traffic on U.S. Highway 191 would more than double current traffic levels on this highway. There would also be some cumulative impact from Jonah II Field and Pinedale Anticline traffic on State Highway 351. However, until further drilling can be completed in the PAPA, it is impossible to estimate the level of cumulative traffic on this highway. In addition, it is not known what percentage of the Jonah II Field traffic will utilize State Highway 351.

Although significant traffic impacts are anticipated from the project, no additional significant cumulative traffic impacts are anticipated on county or BLM roads in the CIAA. It is expected that roads in the northern part of the Jonah II Field would be utilized to access portions of the PAPA. Where these overlapping road uses occur, the transportation planning process would address the cumulative traffic levels and need for road maintenance agreements.

Other oil and gas development projects in the Pinedale RMP area listed on Table 5-2 are not anticipated to significantly affect transportation resources. Even though the RFD for the RMP area includes 1,944 additional wells, the majority are associated with Jonah, the Pinedale Anticline and the CAP project areas. The 200 additional wells outside of these project areas could occur anywhere within the RMP area and are not likely to cause any individual or cumulative significant adverse impacts to

transportation. Most of the future transportation impact is anticipated to occur in association with the cumulative impacts from development within the Jonah II Field and Pinedale Anticline Project areas.

5.5 Land Use/Residential Areas

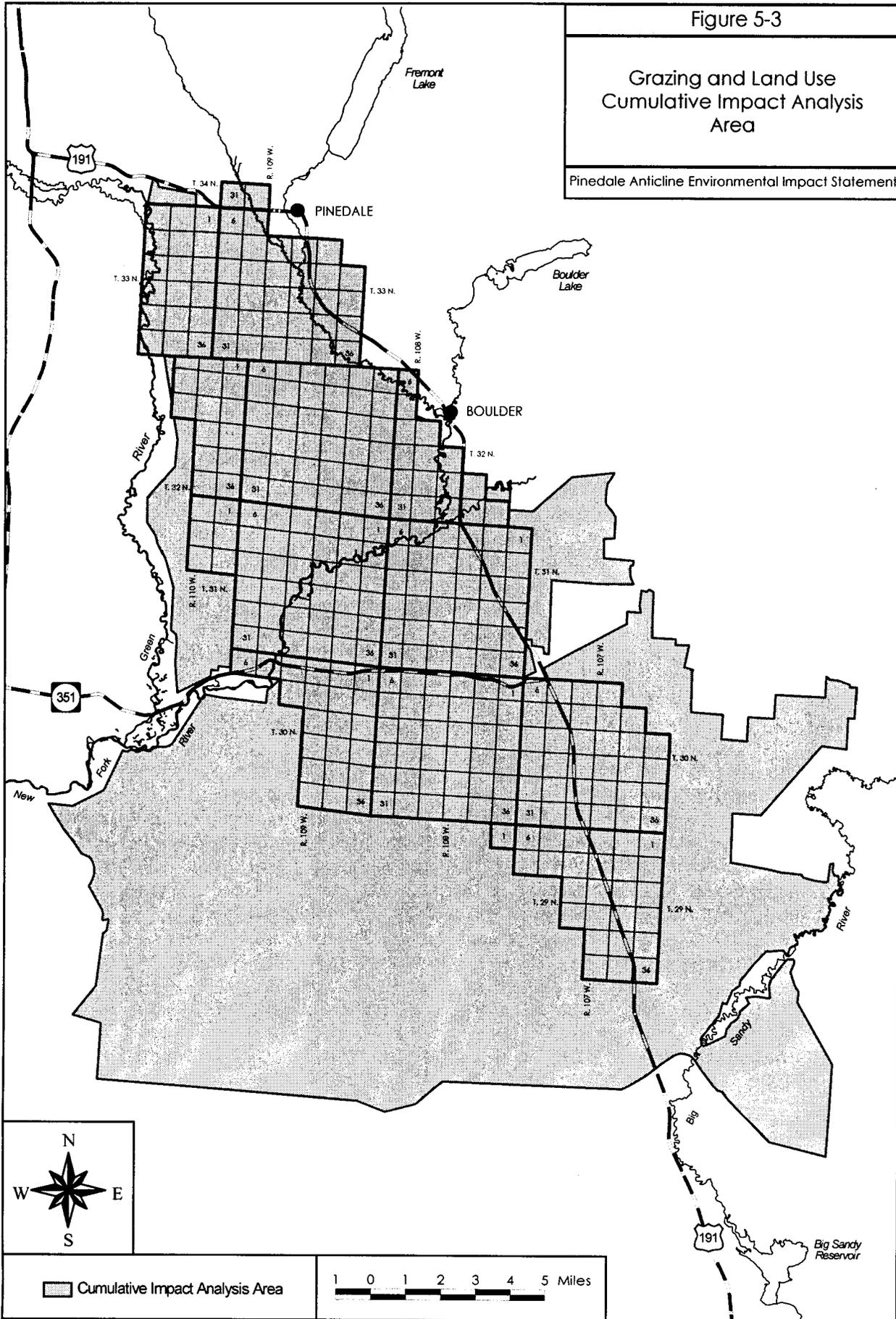
The CIAA for land use, shown on Figure 5-3, includes 414,981 acres (648 square miles). This CIAA consists of all the Federal grazing allotments that overlap the PAPA. The Residential CIAA is the same as the Residential SRMZ shown on Figure 3-7. The principle cumulative land use impact would be the conversion of rangeland to oil and gas development use (compressor stations, centralized production facilities, well pads and roads). There are currently 149 wells and approximately 961 miles of roads in the Land Use CIAA. Existing disturbance in the CIAA is about 2,952 acres (0.7 percent of the CIAA). The SS Alternative would allow construction and drilling of up to 700 additional producing well pad locations in the CIAA. This alternative would result in an estimated long-term conversion of approximately 1,914 acres of the CIAA to oil and gas development use. The RP Alternatives would utilize pad drilling and would convert approximately 1,340 acres from rangeland to long-term oil and gas use (a reduction of about 575 acres when compared to the SS Alternative). The total long-term oil and gas disturbance existing in the entire RMP Area is approximately 14,076 acres. This is based on 1,815 existing wells and 3,915 miles of roads (this includes all roads not just oil and gas roads). Cumulatively, with the addition of 1,944 RFD wells, this would mean a potential for 6,300 acres of long-term disturbance or 0.4 percent of the RMP Area. This is based on a long-term disturbance of 1.5 acres per well and 0.6 miles of road/well with a long-term disturbance of 2.9 acres per mile of road.

Cumulative impacts within the CIAA would result from development associated with the Jonah II Field and future development that may occur from exploratory, wildcat drilling in the CIAA. The Jonah II Field EIS (BLM, 1997a) analyzed 450 well locations and about 600 miles of roads or road improvement with a total long-term disturbance of about 934 acres. The Jonah II Field development would occur in the Desert Common, Stud Horse Butte and Boundary allotments, with most development occurring in the Desert Common Allotment. All of these allotments overlap with the PAPA and cumulative impacts would occur in each. Added together, there could be as much as 5,800 acres (1.4 percent of the CIAA) of

Figure 5-3

Grazing and Land Use
Cumulative Impact Analysis
Area

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long-term cumulative disturbance in the CIAA with the SS Alternative and 5,000 acres of long-term cumulative disturbance for the RP alternatives (1.2 percent of the CIAA). Although the total disturbance percentage is relatively small (considering the entire CIAA), where development from these projects occurs, the change in land use would be significant.

Oil and gas development would be interspersed with rangeland in the CIAA. Human activities associated with the rangeland, such as cattle grazing, would continue in addition to oil and gas development. However, the change in the character of the existing landscape (natural, relatively undisturbed) and change in land use from grazing to an oil and gas use would be significant in the areas that are extensively developed in the CIAA.

Cumulative impacts to residential areas (e.g., Town of Pinedale, Bargerville, ranches, etc.) from other projects (e.g., Jonah II Field) would not occur because the Jonah II Field, or any other oil and gas development project area, is not in close proximity to the residential areas adversely affected by the Pinedale Anticline Project.

Additional development in the Burley and Big Piney-LaBarge CAP area would occur in areas where land use is already predominantly developed. However, the RFD includes a projection of 200 wells that may be drilled anywhere in the Pinedale RMP Area during the next 10 to 15 years. These additional wells are not expected to have a significant impact to land use because they are expected to be widely dispersed, wildcat wells. Impacts from these wells are expected to be geographically isolated. On the other hand, there is the potential for significant impact to occur in some areas because some of the land does not contain improved access. Wildcat wells can establish access corridors where none previously existed. Also, there is no pipeline infrastructure to carry produced hydrocarbons from wildcat wells to market. However, given the history of wildcat drilling outside the known productive areas in the RMP area, the impacts to land use would be temporary because most of the wells would be expected to be dry holes and associated well pads and roads would be reclaimed. Existing roads are used for the most part, however, if an individual well could cause potentially significant impacts or if a field is discovered, an EA/EIS would be prepared to evaluate the project specific impacts.

However, much like wells in the PAPA, some of the projected 200 RFD wells could result in significant impacts to residential areas. Most of the future conflict is expected on non-Federal lands and minerals. Residential development in the Pinedale RMP Area is expected to continue to grow at a rate exceeding the state average and perhaps faster than in neighboring Teton County (see Section 3.5). Conflicts with proposed oil and gas development will continue. Current state regulations restrict placement of pits closer than 350 feet from occupied dwellings. The operators have voluntarily agreed to adhere to the same restrictions for well pads. The public will continue to perceive this limit as insufficient to protect residential uses. It is anticipated that demands will be made by the Sublette County Planning and Zoning Department to resolve conflicts where BLM lacks regulatory authority to limit impacts.

Land use impacts associated with oil and gas development are inevitable and BLM will need to plan for exploratory well, road and pipeline construction carefully to reduce impacts associated with this type of activity. However, and perhaps more importantly, impacts to residential users need to be carefully scrutinized as the BLM makes decisions to lease minerals in the Pinedale RMP Area in the future. First it is recommended that BLM evaluate or consider not leasing minerals in residential areas in the future; second, if leasing is determined appropriate, it is recommended that all leases issued in the future in the expanding residential development areas of the Pinedale RMP Area include a no surface occupancy (NSO) stipulation that avoids placement of well pads or production equipment within 0.25 miles of any occupied dwellings, subdivisions or subdivided lands, or areas zoned by Sublette County for residential use. Just restricting well pad placement to within 0.25 miles of occupied dwellings is not considered adequate for protecting areas designated for future residential use. Protecting adjacent residential land uses should be a primary concern when BLM reviews APDs throughout the Pinedale RMP Area. Leasing of Federal minerals under private or state lands identified for future residential use should have a 0.25 mile NSO (no surface occupancy) stipulation applied or it could be withheld from lease. The Federal mineral resource forgone would be a trade-off for human health, safety and quality of life.

5.6 Recreation Resources

The CIAA for recreation includes the entire Pinedale Field Office Area and the small portion of

the Green River Field Office Area outlined on Figure 5-4 (approximately 1,724,015 acres). The CIAA is composed of undeveloped public lands that have an open landscape setting that would provide solitude for dispersed recreational activities. Private lands are not included in the CIAA because these areas are not considered available to the general public. An analysis was performed to determine those areas in the CIAA that are within 1-mile of existing oil and gas wells which could be considered to have a developed setting. These developed lands comprise approximately 305,534 acres (30 percent of the total Federal and state lands within the Pinedale RMP Area). The landscapes within the developed areas have become substantially altered from their original natural setting. These developed areas are not included in the CIAA because they would most likely be avoided by individuals seeking open space and solitude to enjoy dispersed recreational activities (e.g., hunting, hiking, mountain biking, cross-country skiing, wildlife viewing, etc.). Based on this analysis, approximately 724,459 acres (1,132 square miles; 70 percent of the Federal and state lands within the RMP area) of undeveloped Federal and state lands are available in the CIAA for most dispersed recreational activities. The boundaries for this CIAA were selected because it is believed that any dispersed recreation use displaced from the project area would move to other undeveloped Federal lands in the Pinedale Field Office Area because these areas would offer similar recreational opportunities.

The undeveloped Federal and state lands within the CIAA would provide a landscape setting characterized by open space and solitude which would support a high quality experience for dispersed recreational activities. In addition to these undeveloped lands within the CIAA the area surrounding the CIAA is almost entirely public lands administered by the USFS which would provide other numerous recreational opportunities. For example, in Sublette County alone there are approximately 1,116,060 acres of USFS lands that are outside the CIAA that would provide other exceptional recreational possibilities. Designated wilderness areas make up approximately 439,379 acres or 39 percent of the USFS lands in Sublette County. Although site-specific impacts to recreation in certain areas in the PAPA are considered significant for each alternative in this EIS (see Section 4.7.3) cumulative impacts are not anticipated to occur to the Recreation SRMZ. This is because no other known oil and gas activities are proposed that would add to the impacts projected for the alternatives. The Pinedale Anticline

Project, when combined with additional development associated with the Jonah II Field, would reduce the opportunity for dispersed recreation in the southern portion of the Pinedale RMP Area. Individuals that have been displaced from these areas would consider this an impact, however, the BLM has not monitored dispersed recreation use in these areas to quantify the magnitude of this potential impact.

Cumulative impacts may occur to those people that do not pursue recreational opportunities on the undeveloped public lands in the CIAA and wish to continue to recreate in the PAPA. These people would most likely have a less rewarding recreational experience because of the proposed development and associated traffic which would change the existing open landscape to a developed setting. These individuals may also choose to recreate less frequently if their recreational experience become less enjoyable and they are unwilling to seek other areas than the PAPA for recreation. Those who continue to recreate in the PAPA may create additional cumulative impacts to the sensitive resources in the project area because their activities may exacerbate the impacts predicted for the project alternatives. However, these potential cumulative impacts are expected to be insignificant because the magnitude of dispersed recreational impacts are generally minor for most activities (i.e., human presences is temporary and short-term).

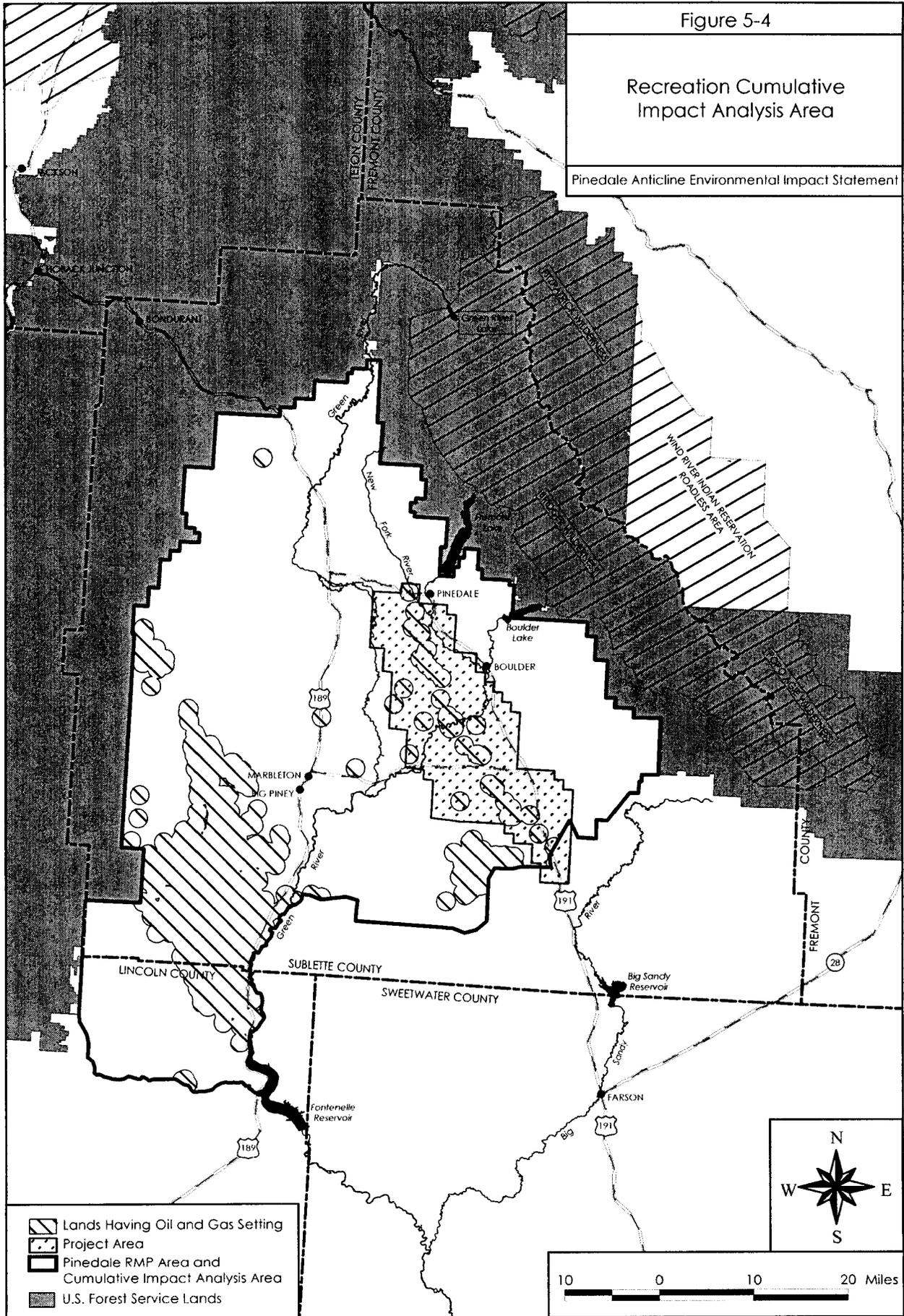
Cumulative impacts may occur in the CIAA where people who have been displaced by oil and gas development move to other undeveloped lands in the CIAA to recreate. These displaced individuals could impact these undeveloped areas because of the increased use these areas would receive. Heavily used areas may have a loss of solitude. Individuals that have been dispersed to other areas to recreate may have a less enjoyable experience because of the loss of solitude, they are forced to travel to other areas, or because they are less familiar with the area. These potential impacts, however, are expected to be minor because of the vast area of public lands available in the CIAA and in Sublette County that would provide numerous opportunities for many recreational activities. Pinedale's outdoor recreation web page¹ and associated links, described the recreational opportunities that abound in the Pinedale area.

¹ see <http://www.pinedaleonline.com/OutdoorRec>

Figure 5-4

Recreation Cumulative
Impact Analysis Area

Pinedale Anticline Environmental Impact Statement



Approximately 1,944 new/replacement wells could be developed in the Pinedale RMP Area during the next 10 to 15 years. Many of these wells would be associated with the Jonah II Field and the Pinedale Anticline Project. Other development would occur in the Big Piney-LaBarge CAP area and other fields where recreation opportunities have already been diminished. However, significant impacts to recreation could still occur if the 200 additional wells that could occur anywhere within the RMP area are located along the Wind River Front or near other sensitive areas that have not previously experienced oil and gas development. These impacts could be particularly severe if wells are drilled near established recreational facilities (campgrounds, snowmobile trails), historic sites and trails and quality fishing streams. The recommendation to not lease in the vicinity of sensitive recreation resources is justifiable considering the potential for significant conflicts with recreation users. Leases would not be issued in this area until further analysis and public input has occurred and the Pinedale RMP has been updated.

The BLM Pinedale Field Office should begin preparation of a Wind River Front SRMA Plan to complement the plan prepared by the Green River Field Office. That plan should evaluate realistic mechanisms for managing conflicts between mineral development and recreation and other uses. Although a number of mitigation opportunities are included in the Green River RMP (i.e., pad drilling, developing only certain portions of the SRMA, etc.), the plan should be expanded for the RMP area to identify areas where oil and gas leasing should not occur to protect significant recreation resources. For instance, the current restriction of 0.25 miles to protect developed recreation sites should be reevaluated in recognition of the topography and setting of a number of the recreation resources in the Wind River Front. Allowing development within 0.25 miles of certain types of recreation sites may still result in a significant impact to the recreation user.

Sublette County is attempting to diversify its economy and many in the county believe that recreation provides a significant diversification opportunity. BLM would work with Sublette County to determine what steps can be taken to develop and protect recreation opportunities on Federal lands including improving accessibility to the Lander Trail for the traveling public.

No leasing decisions along the Wind River Front SRMA may be warranted if development in the Jonah

II Field and Pinedale Anticline accelerate at levels predicted in this EIS. It may be desirable not to open up leasing in the Wind River Front to assure protection of dispersed recreation opportunities that would be lost in the Jonah II Field and Pinedale Anticline project areas.

5.7 Visual Resources

The Visual CIAA includes a one mile buffer around the PAPA and has been extended to include the area around Pinedale, Boulder and to the Green River to include residences outside, but adjacent to, the PAPA. The Visual CIAA is 291,062 acres in size (455 square miles) with 46,867 acres of VRM Class II areas (16.1 percent). There are approximately 2,354 acres of disturbance associated with existing oil and gas wells and roads in the Visual CIAA. However, only three wells and 116.9 miles of roads occur in VRM Class II areas which accounts for about 344 acres of disturbance. This disturbance is less than one percent of the VRM Class II areas in the Visual CIAA. As described in Section 4.8.3, all of the proposed project alternatives, except the No Action Exploration/Development Scenario could significantly impact the VRM Class II and sensitive viewshed areas in the PAPA. In other words, the VRM II classification criteria could not be met or maintained. However, no development proposals in addition to the Pinedale Anticline proposal has been identified that would be located in VRM Class II areas or within the Sensitive Viewshed SRMZ. Other NEPA permitted projects in the Visual CIAA include only the Jonah II Field. The Jonah II Field is located in areas classified as VRM Class III and IV and would not add cumulatively to any VRM Class II area impacts or contribute to impacts within the Sensitive Viewshed SRMZ. Therefore, additional significant cumulative impacts are not anticipated.

If the 200 projected wells which could be located anywhere within the RMP area in the next 10 to 15 years are located in the vicinity of existing oil and gas development, or in VRM Class III or IV areas, there would not be any significant impacts to the visual resources. However, this development could result in significant impacts if it occurs in VRM Class II areas, along the Wind River Front or Gros Ventre foothills, near the Lander Trail, or if it occurs in sensitive viewsheds such as near residential areas.

The first step BLM would take to identify and evaluate sensitive and important visual resources in the RMP area is to update the VRM classifications.

The 1988 VRM classifications are seriously outdated and will only get more difficult to update as additional leases are granted and residential areas develop. The Lander Trail should be considered when updating the VRM classifications. It may be appropriate to evaluate viewsheds associated with the trail and develop strategies for reducing impacts to the trail's setting from development of adjacent leases. The VRM update should also consider and predict, with the assistance of Sublette County, where residential development in the RMP area is likely to occur. Maintaining visual integrity from areas designated for primarily residential use by Sublette County should be considered. When the VRM classifications are revised, oil and gas leasing should not occur in any areas designated as VRM Class I or II or if it does it should be with NSO or other appropriate stipulations. Additional methods to protect other important viewsheds should be developed by BLM and incorporated into leases. Implementation of the project would substantially alter the existing landscape regardless of VRM classification.

5.8 Cultural and Historic Resources

It is assumed that new roads could be constructed anywhere within the PAPA. New roads provide access to previously inaccessible areas and opportunities for pilfering of cultural and/or historical resources. To establish the CIAA for cultural and historical resources, it was further assumed that a two mile buffer around the PAPA would provide a reasonable limit to the distance most offenders would travel from roads in search of cultural or historic artifacts.

The Cultural and Historic Resources CIAA is 330,742 acres in size and currently has approximately 2,624 acres of disturbance associated with existing oil and gas wells and roads, in addition to roads used by hunters, recreationists and livestock operators, all of which account for less than one percent of the CIAA. This disturbance includes approximately 881 miles of existing roads and two tracks. The Pinedale Anticline Project would potentially add between 155 and 280 miles of new local and resource roads from the SS or the RP alternatives, respectively. Cumulative impacts in the Cultural and Historic Resource CIAA from other NEPA permitted oil and gas development would occur from the Jonah II Field. The additional disturbance (including new road construction) could increase cumulative impacts because increased access and human presence may allow increased illegal artifact collection. Although these indirect impacts are

difficult to prevent, they can be minimized if the mitigation measures described in Section 4.9 are implemented to protect significant sites. The transportation planning process would ensure that road development in the Cultural and Historic Resources CIAA is coordinated with development in the Jonah II Field to minimize road development. Because of the unpredictable nature of archaeological discoveries made during construction in the PAPA, adverse effects could occur to sites not identified by normal inventory/evaluation work.

Cumulative effects to cultural resources could occur on private lands as a result of development in the PAPA. Unless the project element contains a Federal licence or permit, no mechanism exists to protect or manage affected cultural sites on private land. Much of the private land is located on the terraces and adjacent alluvial soils of the Green and New Fork rivers, very high site potential zones for containing both significant prehistoric and historic sites. Lacking Federal oversight, these cumulative effects will go unmitigated. Resultant cumulative effects can be quite severe, including impacts to the rural, cultural and historical landscape.

The 200 projected wells, which could be located anywhere within the RMP area, but outside existing developed areas (i.e., Pinedale Anticline Project, Jonah II Field, CAP, Castle Creek), within the next 10 to 15 years, could cause significant impacts to the setting of the Lander Trail. For example, if the development were to occur near segments of the Lander Trail containing integrity, impacts to the trail's setting could occur even if no development is allowed within 0.25 miles of the trail. As within the PAPA, impact to the trail's setting from development could be significant depending on the location and density of adjacent development. Some of the trail segments could be directly affected because not all of the lands crossed by the trail are Federally owned. Restrictions on development-related impacts to the trail are currently applicable only to Federal lands and minerals.

Oil and gas development in the vicinity of the Lander Trail will continue to be problematic in the RMP area for both the BLM and oil and gas lessees. BLM should evaluate future leases adjacent to these trail segments and apply NSO stipulations where the setting of the trail could be adversely affected. To continue to issue leases with only a 0.25 mile protective buffer in areas where additional protection

is warranted is problematic for both the lessee and the BLM.

In addition to the problems associated with the trail on Federal lands and minerals, the State of Wyoming should decide what level of protection is adequate for the trail on state lands and minerals. Currently, the state does not apply any restrictions to development on or near historic trails. This policy should be revisited. It is inconsistent for the Wyoming State Historic Preservation Office to recommend significant indirect impact reductions on Federal lands while that agency remains powerless to reduce direct impacts to the trail on state lands.

5.9 Air Quality and Noise

The CIAA for air quality consists of all of Sublette, Fremont, Lincoln, Uinta, and Sweetwater counties and portions of Teton, Hot Springs, Washakie, Natrona, Carbon and Johnson counties (see Figure 3-13). Cumulative impacts within the CIAA would result from development associated with the Pinedale Anticline Project, other NEPA approved projects (see Table 5-1) and from future drilling that may occur from exploratory, wildcat drilling within the CIAA.

Emissions Inventory. For the cumulative analysis, two emissions source categories were developed in addition to the Pinedale Anticline Project source emissions. The first category included an estimation of the emissions from sources that were permitted or began operation between 1995 and 1998 (emissions for sources operating before 1995 are included in background monitoring data). The second category included an estimation of emissions from reasonably foreseeable development (RFD). This includes emissions from wells and compression addressed in previously approved NEPA documents which had not been constructed as of December, 1998. It also includes estimated emissions from 200 additional wells which could be drilled anywhere within the Pinedale RMP Area. The estimated emissions from 1995 to 1998 sources and the RFD sources were added to the Pinedale Anticline Project estimated emissions to obtain the cumulative emissions inventory (see Air Quality Technical Report for discussion on emissions inventories).

Cumulative impacts were analyzed for the Project Wide and Anticline Crest scenarios for both 500 and 700 producing wells. They were also analyzed for three compressor engine NO_x emission rates (1.5, 1.0 and 0.7 g/hp-hr) and for three potential compressor

station locations (slightly southeast of the centroid of the PAPA, slightly northwest of the centroid of the PAPA and immediately south of the PAPA). This results in a combination of 36 potential scenarios which were analyzed. Cumulative emissions inventories were estimated for NO_x, SO₂, VOCs, CO, PM₁₀, and PM_{2.5} (see Air Quality Technical Report). A summary of the cumulative emissions inventories is provided in Table 5-3.

Near Field Regulated and PSD Pollutant Ambient Concentrations. The CALPUFF model was applied in a near-field mode to estimate cumulative short-term (less than or equal to 24-hour) and long-term (annual) regulated pollutant concentrations for comparisons against National Ambient Air Quality Standards (NAAQS) and Wyoming Ambient Air Quality Standards (WAAQS) within the immediate vicinity of the PAPA (on and within approximately 3 miles of the PAPA). The results were also compared to the PSD Class II increments (see Table 5-4). Presented here are the results of cumulative impacts analysis at the Bridger Wilderness Area for the Project Wide Scenario, 700 producing wells, a compressor engine NO_x emission rate of 1.5 g/hp-hr, and compressor station location C1 (slightly southeast of the centroid of the PAPA). This case resulted in the greatest impact out of all the project scenarios and alternatives modeled. The results for all the other cases are provided in the Air Quality Technical Report.

When the maximum estimated concentrations are added to the existing maximum background concentrations, the total estimated concentrations for all regulated pollutants are less than the applicable NAAQS and WAAQS. Therefore, the cumulative emissions do not cause an exceedance of either the PSD Class II increments or the ambient air quality standards within and in the vicinity of the PAPA (within 3 miles).

Far Field Regulated and PSD Pollutant Ambient Concentrations. The CALPUFF model was also applied to an area in southwest Wyoming to estimate the far-field air quality and Air Quality Related Values (AQRV) impacts of the cumulative emissions from producing natural gas wells, well construction and drilling, and compressor engines. The cumulative far-field modeling estimated the total concentration impacts due to the existing background, the Pinedale Anticline Project and all RFD emissions (see Table 5-3). Impacts on air quality were

**Table 5-3
Summary of Cumulative Emissions Inventories for the Pinedale Anticline Project**

	Emissions (tons/year)					
	NO _x	SO ₂	VOCs	CO	PM ₁₀	PM _{2.5}
Project Wells - Construction	272.2	4.9	63.9	346.5	328.5	91.9
Project Wells -Operation	44.8	0.3	7,129.8	44.8	3.5	3.5
Project Compression (26,000 hp)	251.1 ⁽¹⁾	0.5	78.6	753.2	25.1	25.1
Regional Wells (1998-1995) Production	0.4 -(0.8) ⁽³⁾	--- ---	--- ---	--- ---	--- ---	--- ---
Regional permitted sources (1998-1995)	2,952.3 -(1,131.0) ⁽³⁾	1,621.0 -(556.6) ⁽³⁾	--- ---	--- ---	599.2 -(324.9) ⁽³⁾	251.6 -(149.4) ⁽³⁾
RFD Wells	522.9	---	---	---	---	---
RFD Compression	1,751.6 ⁽²⁾	---	---	---	---	---
Total	4,663.5	1,070.1	7,272.3	1,144.5	631.4	222.7

(1) 1.0 g/hp-hr, (2) 1.5 g/hp-hr, (3) negative emissions.

**Table 5-4
Comparison of Near-Field Cumulative Air Quality Concentrations with PSD Class II Increments and WAAQS and NAAQS (ug/m³)**

Pollutant	Averaging Time	Cumulative Sources	Class II PSD Increment	Monitored Background	Cumulative Sources Plus Monitored Background	WAAQS	NAAQS
SO ₂	Annual	0.01	20	9	9	60	80
SO ₂	24-hour	0.24	91	43	43	260	365
SO ₂	3-hour	0.95	512	132	133	1,300	1,300
PM ₁₀	Annual	0.24	17	8	8	50	50
PM ₁₀	24-hour	6.02	30	18	24	150	150
PM _{2.5}	Annual	0.09	N/A	5	5	15	15
PM _{2.5}	24-hour	1.65	N/A	10	12	65	65
NO ₂	Annual	0.19	25	9	9	100	100
CO	1-hour	89.28	N/A	3,500	3,589	40,000	40,000
CO	8-hour	58.77	N/A	1,500	1,559	10,000	10,000

For averaging times of 24 hours or less, maximum hourly emissions were used, for annual averaging times, annual emissions were used. Presented results are for the Project Wide Scenario, 700 producing well, compressor engine NO_x emissions of 1.5 g/hp-hr and compressor station location C1.

estimated at nearby Class I and Class II areas. The model estimated pollutant concentrations at sensitive receptors in the Class I and Class II mountainous areas east and north of the project including:

- Bridger Wilderness Area (Class I);
- Fitzpatrick Wilderness Area (Class I);
- Washakie Wilderness Area (Class I);
- Grand Teton National Park (Class I);
- Popo Agie Wilderness Area (Class II);

- Wind River Indian Reservation Roadless Area (Class II).

The model was used to estimate ambient SO₂, NO₂, PM₁₀ and PM_{2.5} concentrations to address potential impacts and for comparison with NAAQS, WAAQS, and PSD increments. The estimated maximum regulated and PSD pollutant concentrations at the Bridger Wilderness Area are provided in Table 5-5 which are for the case resulting

in the greatest impact of all the modeled runs (i.e., Project Wide Scenario, 700 producing wells, compressor engine NO_x emissions of 1.5 g/hp-hr and compressor station location C1). The far-field ambient concentration impact results for all of the cumulative emissions scenarios are provided in the Air Quality Technical Report. As shown in Table 5-5, the cumulative sources do not exceed either the PSD Class I increments or the ambient air quality standards at the sensitive receptor areas.

Visibility Impacts. The effects of the cumulative emissions on visibility degradation at the sensitive receptor areas were evaluated using the IWAQM/FLAG-recommended method (see Air Quality Technical Report). In this method, the visibility degradation due to cumulative sources were compared against a background visibility based on the mean of the 20 percent cleanest days from a long-term (typically 8 year) record of the IMPROVE aerosol monitoring data. For the sensitive areas studied in this analysis, the Bridger IMPROVE data was used because it is the most representative (see Section 3.11 in Chapter 3).

There are two thresholds of visibility change which are used for reporting purposes: the number of days in which the deciview (dv) change is 1.0 or greater and 0.5 or greater. The USFS uses the 0.5 dv change as a LAC threshold in order to protect visibility in sensitive areas. The 1.0 dv change threshold is used in the Regional Haze Regulations as a small but noticeable change in haziness and has been used by other agencies as a management threshold. The 0.5 dv change and 1.0 dv change thresholds are neither standards nor regulatory limits. Rather, they are used to alert the affected land managers that potential adverse visibility impacts may exist and the land manager may wish to look at the magnitude, duration, frequency, and source of the impacts in more detail in order to make a significance determination.

Tables 5-6 through 5-9 present the results of the visibility impact analysis for both the Project Wide Scenario and the Anticline Crest Scenario as well as for 500 and 700 producing wells. All of the tables present results from compressor station C1 (results for all compressor station locations are provided in the Air Quality Technical Report). Results are presented for the number of days in which the 0.5 dv change and 1.0 dv change thresholds were exceeded during 1995, the baseline year.

The 1.0 dv change threshold was not exceeded due to cumulative emissions for any of the emissions scenarios and alternatives. The 0.5 dv change threshold, however, was exceeded and the number of days that it was exceeded varies with the different Pinedale Anticline scenarios and alternatives. The most impact (number of days that the 0.5 dv change is exceeded) occurred at the Bridger Wilderness Area, with fewer days exceeded at the Fitzpatrick and Popo Agie wilderness areas as well as the Wind River Indian Reservation Roadless Area. The greatest cumulative visibility impacts occurs for the Project Wide Scenario, 700 producing wells, compressor engine NO_x emissions rate of 1.5 g/hp-hr at compressor station location C1 (see Table 5-6). For this case, there are 9 days exceeding the 0.5 dv change threshold at the Bridger Wilderness Area, 2 days each exceeding the 0.5 dv change threshold at the Fitzpatrick and Popo Agie wilderness areas and the Wind River Indian Reservation Roadless Area. These worst case results are estimated to produce 15 total visibility event days that exceed the 0.5 dv change threshold. Due to the close proximity of the four sensitive areas in the Wind River Range, one bad day could produce up to 4 visibility event days exceeding the 0.5 dv change threshold. For example, for the 15 total visibility event days shown in Table 5-6, there are actually only 9 different days that the 0.5 dv change threshold was exceeded. The Air Quality Technical Report provides further discussion of reporting of multiple days and presence of weather events.

The modeled case with the greatest impacts include a compressor engine NO_x emissions rate of 1.5 g/hp-hr. More likely would be the Project Wide or Anticline Crest scenario with 700 producing wells and a compressor engine NO_x emission rate of 1.0 or 0.7 g/hp-hr. For the Project Wide Scenario, the total visibility event days at all areas that the 0.5 dv change threshold are exceeded are reduced to 10 (1.0 g/hp-hr) and 9 (0.7 g/hp-hr) (see Table 5-6). Implementation of the Anticline Crest Scenario would cause less of a visibility impact than for the Project Wide Scenario (see Table 5-8).

Acid Deposition Impacts. The potential impact of the cumulative emission sources on acid deposition for the modeled case with the greatest impact (Project Wide Scenario, 700 producing wells, compressor engine NO_x emissions of 1.5 g/hp-hr) are provided in Table 5-10. Results of all other scenarios and alternatives are presented in the Air Quality Technical Report. The change in ANC due to the cumulative

**Table 5-5
Comparison of Far-Field Cumulative Air Quality Concentration with PSD Class I Increments and WAAQS and NAAQS At Bridger Wilderness Area ($\mu\text{g}/\text{m}^3$)**

Pollutant	Averaging Time	Cumulative Sources	Class I PSD Increment	Monitored Background	Cumulative Sources Plus Monitored Background	WAAQS	NAAQS
SO ₂	Annual	0.00	2	9	9	60	80
SO ₂	24-hour	0.09	5	43	43	260	365
SO ₂	3-hour	0.28	25	132	132	1,300	1,300
PM ₁₀	Annual	0.02	4	8	8	50	50
PM ₁₀	24-hour	0.20	8	18	18	150	150
PM _{2.5}	Annual	0.01	N/A	5	5	15	15
PM _{2.5}	24-hour	0.10	N/A	10	10	65	65
NO ₂	Annual	0.03	2	9	9	100	100

Annual average emissions were used. Presented results are for the Project Wide Scenario, 700 producing wells, compressor engine NO_x emissions of 1.5 g/hp-hr and compressor station location C1.

**Table 5-6
Summary of Visibility Impacts from Cumulative Emissions Sources for the Project Wide Exploration/Development Scenario with 700 Producing Wells**

Sensitive Area	Compressor NOx Emissions of 1.5 g/hp-hr		Compressor NOx Emissions of 1.0 g/hp-hr		Compressor NOx Emissions of 0.7 g/hp-hr	
	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv
Bridger Wilderness Area	9	0	6	0	5	0
Fitzpatrick Wilderness Area	2	0	2	0	2	0
Washakie Wilderness Area	0	0	0	0	0	0
Grand Teton National Park	0	0	0	0	0	0
Popo Agie Wilderness Area	2	0	1	0	1	0
Wind River Indian Reservation Roadless Area	2	0	1	0	1	0
Total Visibility Event Days at All Areas	15	0	10	0	9	0

Compressor Station Location C1

**Table 5-7
Summary of Visibility Impacts from Cumulative Emissions Sources for the Project Wide Exploration/Development Scenario with 500 Producing Wells**

Sensitive Area	Compressor NOx Emissions of 1.5 g/hp-hr		Compressor NOx Emissions of 1.0 g/hp-hr		Compressor NOx Emissions of 0.7 g/hp-hr	
	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv
Bridger Wilderness Area	5	0	5	0	4	0
Fitzpatrick Wilderness Area	2	0	2	0	2	0
Washakie Wilderness Area	0	0	0	0	0	0
Grand Teton National Park	0	0	0	0	0	0
Popo Agie Wilderness Area	1	0	1	0	1	0
Wind River Indian Reservation Roadless Area	2	0	1	0	1	0
Total Visibility Event Days at All Areas	10	0	9	0	8	0

Compressor Station Location C1

**Table 5-8
Summary of Visibility Impacts from Cumulative Emissions Sources for the Anticline Crest Exploration/Development Scenario
with 700 Producing Wells**

Sensitive Area	Compressor NOx Emissions of 1.5 g/hp-hr		Compressor NOx Emissions of 1.0 g/hp-hr		Compressor NOx Emissions of 0.7 g/hp-hr	
	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv
Bridger Wilderness Area	5	0	5	0	4	0
Fitzpatrick Wilderness Area	2	0	2	0	2	0
Washakie Wilderness Area	0	0	0	0	0	0
Grand Teton National Park	0	0	0	0	0	0
Popo Agie Wilderness Area	2	0	1	0	1	0
Wind River Indian Reservation Roadless Area	2	0	1	0	1	0
Total Visibility Event Days at All Areas	11	0	9	0	8	0

Compressor Station Location C1

**Table 5-9
Summary of Visibility Impacts from Cumulative Emissions Sources for the Anticline Crest Exploration/Development Scenario
with 500 Producing Wells**

Sensitive Area	Compressor NOx Emissions of 1.5 g/hp-hr		Compressor NOx Emissions of 1.0 g/hp-hr		Compressor NOx Emissions of 0.7 g/hp-hr	
	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv	Days > 0.5 dv	Days > 1.0 dv
Bridger Wilderness Area	5	0	4	0	4	0
Fitzpatrick Wilderness Area	2	0	2	0	2	0
Washakie Wilderness Area	0	0	0	0	0	0
Grand Teton National Park	0	0	0	0	0	0
Popo Agie Wilderness Area	1	0	1	0	1	0
Wind River Indian Reservation Roadless Area	2	0	1	0	1	0
Total Visibility Event Days at All Areas	10	0	8	0	8	0

Compressor Station Location C1

emissions sources at any of the sensitive lakes is well below the 10 percent LAC threshold and therefore would not be significant.

No cumulative noise impacts are anticipated.

Discussion of Significance. For the cumulative sources, there were no predicted exceedances for any of the thresholds or standards for Class I PSD increments, NAAQS, WAAQS or for impacts to sensitive lakes (acid deposition). The only potential adverse impacts that have been identified are to visibility in the Class I areas, i.e., there are days in which the 0.5 dv change threshold are exceeded for the cumulative sources.

The USFS has reviewed the days of modeled cumulative impacts that are greater than 0.5 dv change and have determined that the cumulative impacts from the Pinedale Anticline Project, combined with other recently proposed projects in southwest Wyoming, are significant in increasing visibility impairment in the Bridger Wilderness Area. This "significance" occurs for several reasons. First, Congress has declared as a National Visibility Goal "the prevention of any future... impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution". Second, The Wilderness Act states that a wilderness should be "unimpaired for future use and enjoyment as wilderness..." and should be managed and protected to "preserve its natural conditions..." Air pollution

Table 5-10
Summary of Analysis of Potential Acid Deposition Impacts for Cumulative Sources

Sensitive Lake	Sensitive Area	Monitored Background ANC (ueq/l)	Change in ANC (percent)
Ross	Fitzpatrick Wilderness Area	55.8	0.134
Hobbs	Bridger Wilderness Area	63.0	0.187
Black Joe	Bridger Wilderness Area	55.2	0.228
Deep Lake	Bridger Wilderness Area	49.0	0.271
Lower Saddlebag	Popo Agie Wilderness Area	58.3	0.248

Presented results are for the Project Wide Scenario, 700 producing wells, compressor engine NO_x emissions of 1.5 g/hp-hr and compressor station location C1. Results for all other scenarios and alternatives are presented in the Technical Support Document.

impacts may be considered by the USFS to be at “unnatural” levels that may “impair” wilderness where these impacts are greater than 0.5 dv change.

This is because visibility degradation at levels above 0.5 dv change may be detected by the human eye under some conditions. Visibility degradation at levels above 1.0 dv change can almost always be detected by the human eye. Therefore, the USFS must make a judgement call about the significance of predicted impairment between 0.5 dv change and 1.0 dv change based on timing, magnitude, and duration of the impacts, and based on the conservatism of the air quality models that are used. However, based on the application of emissions reduction mitigation efforts by Ultra Petroleum at the Naughton power plant (discussed below), and considering the timing, magnitude and duration of the remaining projected cumulative visibility impacts, the USFS considers these impacts to be within an acceptable range. Modeling indicates that air quality in the Bridger Wilderness Area and other sensitive Class I and Class II areas with the Naughton decreases will show a small net air quality improvement over air quality conditions that would be present without the Naughton decreases.

The WDEQ-AQD has also reviewed the days of modeled cumulative impacts that are greater than 0.5 dv change and considered the fact that there are no

modeled impacts over 1.0 dv change. The preamble for the Regional Haze Regulation state that “A one deciview change in haziness is a small but noticeable change in haziness under most circumstances when viewing scenes in Class I Areas.” Based upon that definition and consideration that all of the days of modeled cumulative visibility impacts at Class I Areas had a magnitude of change less than 1.0 dv, the WDEQ-AQD, a cooperating agency, has determined that the cumulative impacts are not significant in increasing visibility impairment. The WDEQ-AQD recognizes that there is concern for visibility impairment in Wyoming Class I areas. Therefore, the WDEQ-AQD will continue to evaluate monitored visibility data to compare with the various model predicted visibility impacts at the Bridger and Fitzpatrick Class I wilderness areas. These comparisons will serve as a “reality check” in verifying the accuracy of the model predicted visibility impacts.

Naughton Power Plant Emissions Reduction.

In anticipation of Potentially significant AQRV impacts, Ultra Petroleum in cooperation with Pacificorp participated in the purchase of Low NO_x Burner Technology (LNBT) controls for Unit 3 of the Naughton coal-fired generating station located near Kemmerer in southwestern Wyoming. The effect of this would guarantee a permitted NO_x reduction of 1,000 TPY. However, the LNBT control is expected to result in approximately 2,000 TPY reduction in NO_x emissions from Unit 3 of Naughton. The BLM and cooperating agencies agreed to examine the potential benefit of the Naughton LNBT controls at 2,000 TPY reduction in NO_x.

Table 5-11 presents the potential visibility benefits of the Naughton NO_x reduction to the Class I and Class II sensitive areas. The analysis of the potential Naughton benefits was done separately from the Pinedale Anticline cumulative impact analysis. Table 5-11 shows that the visibility impairment (where it is greater than 0.5 dv change) would be reduced by 12 visibility event days with the Naughton NO_x reduction.

Visibility event days are the total of all days for all of the Class I and Class II areas on an annual basis. The 12 visibility event days which are eliminated are not necessarily the same calendar day as those presented as Pinedale Anticline cumulative impacts in Tables 5-6 through 5-9. However, this is still a real benefit to the Class I and Class II areas even though the benefits do not occur on the same calendar day as the cumulative impacts. The Air Quality Technical Report contains additional information regarding the benefits of the reduction.

**Table 5-11
Benefit of Naughton NO_x Reduction for each Sensitive Area**

Sensitive Area	Days of Benefit > 0.5 dv
Bridger Wilderness Area	2
Fitzpatrick Wilderness Area	3
Washakie Wilderness Area	0
Grand Teton National Park	1
Popo Agie Wilderness Area	2
Wind River Indian Roadless Area	4
Total Visibility Event Days	12

5.10 Geology and Geologic Hazards

The CIAA for geology and geologic hazards is restricted to the PAPA and cumulative impacts are not expected. As discussed in Section 4.11, geologic hazards are not of notable concern in the PAPA. There are no known landslides and the PAPA is in an area rated low-to-moderate for seismic risk. The BLM's Mitigation Guidelines (see Appendix A) avoid development on slopes greater than 25 percent, which would prevent development on slopes susceptible to slumping or landslides. No other development activities have been identified which would add to impacts to steep slopes.

The Pinedale RMP Area, however, does contain areas with high potential for geologic hazards, such as in the westernmost portion of the area in the Overthrust Belt. Development in this area should be reviewed on a site-specific basis to determine if geologic hazards are present. Future development in the RMP area could also impact the Air Force's Seismic Monitoring Station near Boulder. The Air Force has recommended that a buffer of six miles be established around their site. Leases within the buffer that have expired or are expiring should not be renewed until potential impacts to the seismic monitoring station are adequately addressed.

5.11 Paleontological Resources

Like cultural resources, new roads could provide access to paleontological resources. A two mile buffer around the PAPA was used to establish the Paleontological CIAA. Such a buffer provides a reasonable limit to the distance traveled from existing roads in search of paleontological resources.

No other concurrent or reasonably foreseeable development activities are known for the CIAA which could contribute cumulatively to paleontological impacts. Where the PAPA is adjacent to the Jonah II Field, a higher probability for uncovering paleontological activities may occur because of increased activity levels. Cumulative impacts could occur in the project area during construction in deposits not currently recognized to contain paleontological materials. The location of paleontological materials at localities like Two Elk Spring and Grouse Spring in depositional settings previously considered unlikely to contain fossils, documents that many fossil-bearing sediments are currently unrecognized.

The drilling of up to 1,944 new/replacement wells in the RMP area (see Table 5-2) would increase the potential for discovering significant fossil resources. The extent to which significant fossils would be uncovered is unknown although the highest potential probably exists in the PAPA and Jonah II Field. The 200 projected wells that could occur anywhere within the undeveloped parts of the RMP area may uncover important paleontological resources. If these resources occur on Federal or state lands and minerals, and if presence of paleontological material is recognized, adequate protective measures would be employed to protect the resource. No such protection is afforded to paleontological resources on private lands.

5.12 Water Resources

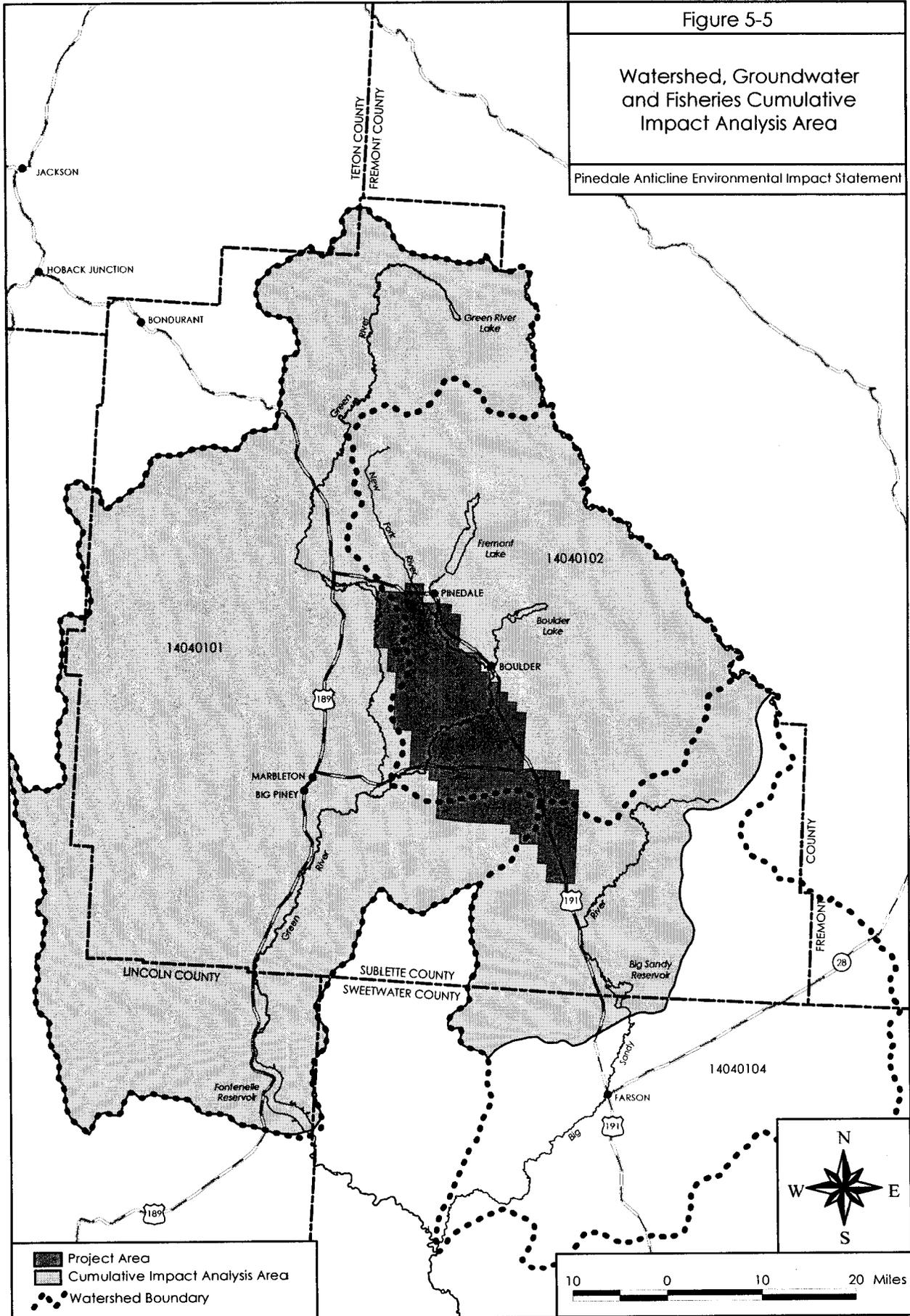
The CIAA for watershed and groundwater includes all of hydrologic units 14040101, 14040102 and those sub-basins in 14040104 which may experience sedimentation impacts from project-related construction activities (Figure 5-5). The watershed and groundwater CIAA is 3,055,785 acres (4,775 square miles).

It is not likely that groundwater resources would be affected outside the PAPA as a result of the Pinedale Anticline Project. When combined with existing groundwater uses in the project area, negligible cumulative impacts to groundwater resources are anticipated. Impacts from the Pinedale Anticline Project include the potential for degradation of groundwater quality and quantity and most impacts would remain within the PAPA. Impacts to ground-

Figure 5-5

Watershed, Groundwater
and Fisheries Cumulative
Impact Analysis Area

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water quality would be minimized by following the mitigation measures described in Chapter 4 for pit design, casing of production wells and by following WOGCC rules for plugging of wells.

Impacts to groundwater quantity could occur from drilling of water supply wells in the project area. This activity would be closely monitored and if impacts are seen, alternate methods for water supply would be investigated.

Presently, there are 21,569 acres of disturbance from 2,245 wells and associated oil and gas development activities within the CIAA. This includes 2,230 acres of disturbance from well pads and 6,284 miles of road. This amounts to 0.7 percent of the CIAA. Long-term disturbance from the Pinedale Anticline Project, combined with existing disturbance, would total 23,483 acres and 22,909 acres for the SS and the RP alternatives, respectively. Both of these equal only 0.7 percent of the CIAA. Potentially, 4,135 new/replacement wells could be developed from NEPA-approved projects within the Watershed CIAA in the next 10 to 15 years, as well as an additional 200 wells that could occur anywhere within the undeveloped parts of the Pinedale RMP Area. If all of these well sites/pads are constructed, and no existing wells were plugged, abandoned and reclaimed, the additional long-term disturbance to the CIAA would be approximately 11,835 acres. This level of disturbance would represent approximately one percent of the total area within the CIAA.

The biggest concern for surface water is the potential for cumulative impacts from sedimentation. Such impacts are impossible to predict but are particularly relevant considering that concern has already been raised regarding background sediment levels in the New Fork River. Any additional sedimentation impacts to these waters would be considered a significant cumulative impact and steps should be taken to prevent any further degradation of the river. Monitoring has been initiated to determine whether the river's existing uses are being achieved. It has been suggested that impairment from sedimentation and stream bank degradation from grazing may already have occurred. If so, any sedimentation contributed to the river from oil and gas development would further exacerbate the problem - perhaps to the point where determination of a total maximum daily load (TMDL - EPAs measure of water quality) would be required. This significant cumulative impact could occur unless steps are taken to improve conformance with storm water regulations

and zero uncontrolled discharge of sedimentation from well pads (as is required by BLM's Mitigation Guidelines) is truly achieved.

Up to 1,944 new/replacement wells could be drilled in the RMP area in the next 10 to 15 years. Most would be developed in the PAPA, Jonah II Field and CAP area. Sediment from all of these wells could enter area waters and cause water quality degradation. It is anticipated that this level of development could result in significant degradation of water quality in area streams (particularly the New Fork and Green rivers), unless actions are taken to implement and maintain adequate storm water BMPs. The impacts of these additional wells on groundwater resources are not anticipated to be significant given application of adequate storm water BMPs.

To prevent significant cumulative impacts to water quality from sedimentation, the BLM and operators must diligently apply and maintain BMPs for controlling off-site sedimentation to all surface disturbing activities in the project area. Disturbance should be carefully controlled so that unprotected sites do not contribute to sediment loading in area waters. Training of BLM and operator personnel may be warranted so that the proper application of BMPs is achieved. It is suggested that the WDEQ/WQD work with operators and the BLM to develop adequate training and inspection requirements and WDEQ/WQD should become much more aggressive in the inspection of storm water controls. Adequate agency manpower needs to be directed to this very important task.

5.13 Soil Resources

The CIAA for soils includes the entire PAPA and a two mile buffer. This area encompasses 330,742 acres (517 square miles). Cumulative impacts as they relate to increased erosion and sedimentation are addressed in Section 5.12. Presently, there are 2,664 acres of disturbance in the Soils CIAA from existing oil and gas wells and roads, and roads/trails used by hunters, recreationists, and livestock operators. Long-term disturbance from the Pinedale Anticline Project would increase disturbance to about 4,578 and 4,004 acres for the SS and RP alternatives, respectively. This cumulative disturbance would account for less than 1.4 percent of the total Soils CIAA. No other projects have been identified that would add to cumulative soil impacts in the project area.

Additional projects in the RMP area would result in direct impacts to soils. These impacts are anticipated to occur over a wide range of soil types with a myriad of characteristics. Significant impacts are not expected as long as the BLM and operators diligently apply BLM's Mitigation Guidelines (see Appendix A).

5.14 Vegetation Resources

The CIAA for vegetation resources is the same as for soils. The cumulative effects to vegetation are primarily the result of road and well pad construction and grazing. Existing wells and roads/trails have removed approximately 2,664 acres in the Vegetation CIAA. Proposed activities associated with the SS Alternative would remove up to an additional 1,914 acres of vegetation in the long-term which would total approximately 4,578 acres or about 1.4 percent of the CIAA. This alternative would increase the vegetation disturbance in the CIAA by about 70 percent over existing conditions. The RP alternatives would remove about 1,340 acres of additional vegetation in the long-term. These alternatives would have a total cumulative impact to vegetation of about 4,578 and 4,004 acres for the SS and RP alternatives, respectively. This amounts to less than 1.4 percent of the CIAA. Additional acreage would be modified from a sagebrush-grass type to a grass-forb type due to pipeline construction and reclamation. Approximately 34 square miles or 36 percent of the Jonah II Field is located within the Vegetation CIAA and therefore, an unknown portion of the 934 acres of long-term disturbance analyzed for the Jonah II Field would add to the cumulative impacts within the CIAA. However, long-term cumulative impacts to vegetation should be negligible because the affected vegetation types are common and widely distributed throughout the region. The implementation of BLM's Mitigation Guidelines (see Appendix A), including reclamation and revegetation, would assure negligible impacts. Sensitive plant species would be protected by site-specific mitigation including avoidance.

The RFD in the RMP area would result in drilling of 1,944 new/replacement wells. This level of development would result in approximately 6,300 acres of additional long-term disturbance to vegetation. The projects that represent the RFD for the RMP area would affect a variety of vegetation types. The implementation of mitigation measures, including reclamation and revegetation, would assure negligible impacts throughout the RMP area.

Sensitive plant species would be protected by site-specific mitigation including avoidance.

5.15 Grazing Resources

The CIAA for grazing is 414,981 acres (648 square miles) and includes all of the allotments that the PAPA overlaps (see Figure 5-3). An estimated 257 AUMs have been lost to existing roads, trails and oil and gas related disturbance in the Grazing CIAA. Combining the maximum production-related disturbance from the SS Alternative (which occurs in year 5 and is estimated at 395 AUMs - see Table 4-24), and the maximum loss of AUMs from the Jonah II Field (60 AUMs), cumulative AUM loss in the CIAA is estimated at 712 AUMs. Based on the 39,468 AUMs available in the 15 allotments in the CIAA (see Table 3-30), this forage loss accounts for only about 1.8 percent of the total AUMs available in these allotments. Cumulative impacts from the RP Alternative would be less than for the SS Alternative.

The 1,944 potential wells included in the RFD for the RMP area would result in a loss of about 548 AUMs. This is based on a long-term disturbance of 1.5 acres per well and 0.6 miles of road/well with a long-term disturbance of 2.9 acres per mile of road. It is also based on an average of 11.5 acres/AUM. When considering this loss would occur over the entire RMP area, the impact from the RFD for oil and gas development would be considered insignificant (0.3 percent of total AUMs for the RMP area).

5.16 Wetland and Riparian Resources and Flood Plains

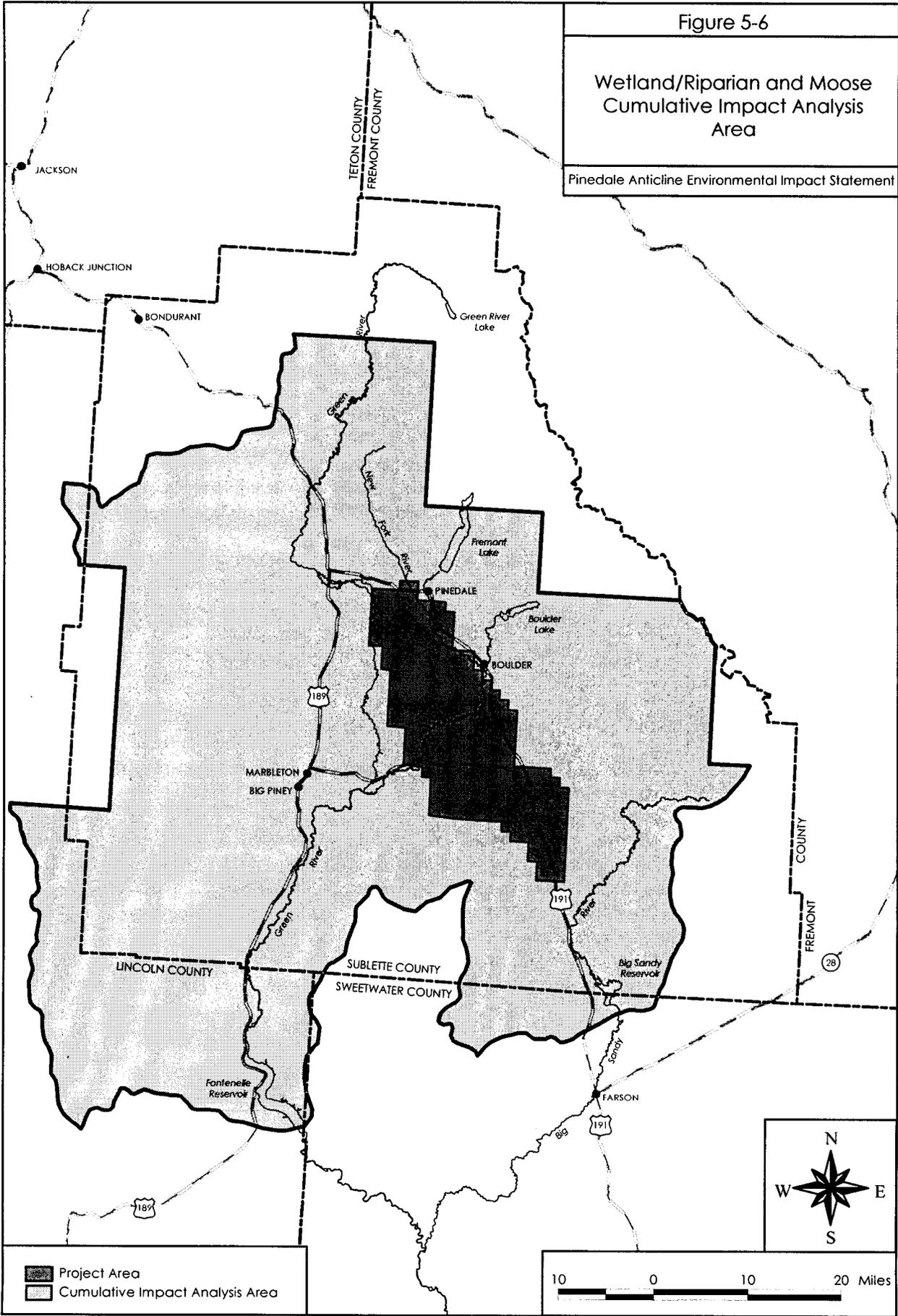
For purposes of cumulative estimates of wetland/riparian impacts, the majority of the hydrologic units listed for watershed and groundwater resources were used to define the geographic extent of the Wetland/Riparian CIAA (see Figure 5-6). Although most of the watersheds are included in the Wetland/Riparian CIAA, portions on the periphery are excluded because digital wetland inventory information is not available. The CIAA encompasses 2,531,756 acres (3,956 square miles) and contains 129,474 acres of wetlands (202 square miles) which is about five percent of the CIAA. The CIAA for flood plains includes the PAPA and a two mile buffer.

To date, 2,225 wells have been drilled in the Wetland/Riparian CIAA. So far, existing disturbance to wetlands associated with well pads and roads within the Wetland/Riparian CIAA totals about 231

Figure 5-6

Wetland/Riparian and Moose
Cumulative Impact Analysis
Area

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acres from only 17 well pads and 71 miles of roads. Oil and gas operators appear to have been diligent in avoiding direct impacts to wetlands and riparian areas. The existing disturbance accounts for 0.2 percent of the total 129,474 acres of wetlands in the CIAA.

In the PAPA, all of the project alternatives, except the RP Alternative on All Lands and Minerals and the No Action Scenario, could cause significant impacts to wetlands in the CIAA. These impacts could far exceed the entire cumulative well pad-related impact to wetlands that have occurred so far from nearly 50 years of oil and gas development in the CIAA. Under the SS Alternative, there are 259 potential well pad locations that could be developed in wetlands on private and state lands and minerals in the PAPA. This disturbance could impact forested or scrub shrub wetlands and cause a significant short-term loss of the function and value of these wetlands. The RP Alternative on Federal Lands and Minerals would cause the same significant impact as the SS Alternative because virtually all of the impacts to wetlands would occur on non-Federal lands and minerals.

Permits under Section 404 of the Clean Water Act would be required for any activity in wetlands. Operators would be required to demonstrate to the COE that there are no "practical alternatives" to placement of a well location in a wetland. Under the RP Alternative on All Lands and Minerals, 503 well pads would be relocated or eliminated within the PAPA to maintain a 500 foot buffer around wetlands. This would prevent significant cumulative impacts to wetlands within the Wetland/Riparian CIAA. Development from the Jonah II Field would occur entirely in upland areas and would not add to cumulative wetland impacts in the CIAA. Depending on the location of the 200 RFD wells projected to be drilled and potentially developed in the RMP area during the next 10 to 15 years, there could be additional, significant impacts to wetlands. Development in areas similar to the PAPA which contain a large amount of wetlands under private or state surface and mineral ownership could incrementally add to wetland impacts in the CIAA.

Implementation of the SS Alternative or RP alternatives on Federal Lands and Minerals for the Pinedale Anticline Project has the potential to locate 232 wells within 100-year flood plains in the PAPA. Presently, only two existing wells and about eight miles of roads occur in flood plains. Sublette County

has developed zoning regulations that address other development activities in flood plains. These regulations, if developed for oil and gas, would prevent the significant adverse impacts to flood ways and flood plains (see Chapter 3).

5.17 Threatened and Endangered Species and Special Status Species

The CIAA used to analyze cumulative impacts on threatened and endangered species and special status species includes the PAPA and two miles beyond the perimeter of the PAPA and the Jonah II Field which is adjacent to the PAPA. Within this area, the distribution and abundance of Federally listed species, species proposed for listing, candidate species, and species with special status recognized by USFWS, BLM and WGFD is extremely limited or unknown. Consequently, the degree to which historical oil and gas activity have cumulatively impacted endangered fish, wildlife and plant species in the CIAA cannot be described or quantified.

Certainly existing surface disturbances, proliferation of roads and residences, and other human-centered land uses (agriculture, livestock grazing, applications of pesticide and herbicides, shrub and tree removal, recreational shooting of prairie dogs) have reduced the amount of habitat available for use by listed threatened and endangered species, proposed and candidate species, and other special status species. Within the 578 square mile CIAA, 149 wells have already been developed along with 961 miles of roads so that, on average, there is approximately one well per five square miles and 1.6 miles of road per square mile in the CIAA. Implementation of any of the alternatives for the Pinedale Anticline Project would increase numbers of wells and miles of road far beyond current densities.

The only Federally listed species known to occur in the CIAA is the bald eagle. Currently there are no wells and only 0.03 miles of road that have been developed within 2,000 feet of the only known active bald eagle nest in the CIAA. Future gas development in the PAPA would not add to these minimal disturbances because a zone of 2,000 feet around that nest and any others that might be constructed would be maintained to exclude surface activities.

Prairie dog colonies provide habitat for endangered black-footed ferrets and proposed mountain plovers. Colonies are most extensive in the PAPA (5,803 acres) with only a few colonies ranging

from 62 to 1,546 acres found in the Jonah II Field (BLM, 1997a). Searches for black-footed ferrets were conducted on prairie dog colonies within the Jonah II Field but none were found. One search for black-footed ferrets has been made within the PAPA and no ferrets were found. Prairie dog colonies are also potential habitat for mountain plovers and burrowing owls. There have been infrequent observations of burrowing owls in the CIAA but there is insufficient information to evaluate cumulative impacts to the species. Mountain plovers could also inhabit desert shrub and mixed grasslands which, together total 66 square miles in the CIAA. There have been recent (1999) observations of this proposed species in the PAPA and CIAA. Similarly, occurrences of other special status species in the CIAA are unknown and future cumulative impacts cannot be evaluated.

A number of conflicts could exist as the 1,944 RFD wells are drilled in the RMP area over the next 10 to 15 years. However, a well defined regulatory process exists that would limit any potential impacts to Federally listed or proposed species. Less protection is provided to species that are not listed or proposed under the Endangered Species Act and the only protection provided to the species on non-Federal lands and minerals is through state game laws. Impacts to non-listed or proposed but still sensitive species could occur during the RFD development in the RMP area.

5.18 Wildlife and Aquatic Resources

The CIAA for pronghorn, mule deer, moose, sage grouse, and raptors are all unique and are discussed in each section below. It is assumed that impacts to fisheries would mainly occur from impacted water quality (increased sedimentation) and therefore, the CIAA for fisheries is the same as that for water resources (see Figure 5-5).

The principal focus of the following analysis is on potential cumulative effects of oil and gas developments on wildlife even though other Federal and/or non-Federal actions in each CIAA have undoubtedly impacted wildlife. These include urbanization, proliferation of roads, wildlife harvest, livestock grazing, and non-consumptive recreation in wildlife habitats.

Pronghorn. The CIAA used to analyze cumulative impacts on pronghorn populations (Figure 5-7) includes all of the seven Antelope Herd Units (Sublette, Uinta-Cedar Mountain, South Rock

Springs, Bitter Creek, Carter Lease, Baggs, and Red Desert) in southwestern Wyoming. In each herd unit, locations of oil and gas wells (from BLM's inventory) and roads (U.S. Department of Commerce, TIGER coverage) were superimposed on seasonal ranges used by each pronghorn population. Densities of active wells (number/square mile) and roads (miles of road/square mile) in crucial winter ranges (including crucial winter-yearlong, winter, and severe winter relief ranges), non-crucial winter ranges (including non-crucial yearlong, winter-yearlong, and winter ranges), and spring-summer-fall ranges were computed for each population. Those results are presented in Table 5-12 along with a listing of oil and gas projects that are being developed or have been developed in each herd unit since 1984.

Of all the pronghorn populations, road proliferation has impacted the Sublette Herd Unit the most. All occupied habitats have been affected especially crucial winter ranges where road densities average more than two miles of road in each square mile of crucial winter habitat. Densities of active wells are also relatively high in all Sublette Herd Unit occupied ranges (Table 5-12). Implementation of any of the alternatives presented for the PAPA would increase well and road densities in crucial and non-crucial winter ranges of the Sublette Antelope Herd Unit above densities shown in Table 5-12. There are at least 7,711 oil and gas wells that could still be drilled in NEPA-approved project areas that overlap with all seven antelope herd units. Of these, 4,317 wells could be drilled in the Sublette Antelope Herd Unit. An additional 200 projected wells could be drilled anywhere within the Pinedale RMP Area in the next 10 to 15 years. There is no way to determine, however, how many of these wells might be drilled in pronghorn crucial or non-crucial winter ranges in the Sublette Antelope Herd Unit or in other herd units in southwestern Wyoming.

The Carter Lease Antelope Herd Unit has been most impacted by oil and gas development with an average of one well per 1.7 square miles of crucial winter range and nearly one mile of road per every square mile of occupied habitat (Table 5-12). That level of industry development occurred in the Whitney Canyon-Carter Lease fields prior to 1984.

Possible effects of major oil and gas projects on pronghorn population parameters that contribute to population growth were examined from pre-harvest herd composition survey field data collected by WGFD in all seven herd units since 1978 (see

Figure 5-7

Antelope Cumulative Impact Analysis Area

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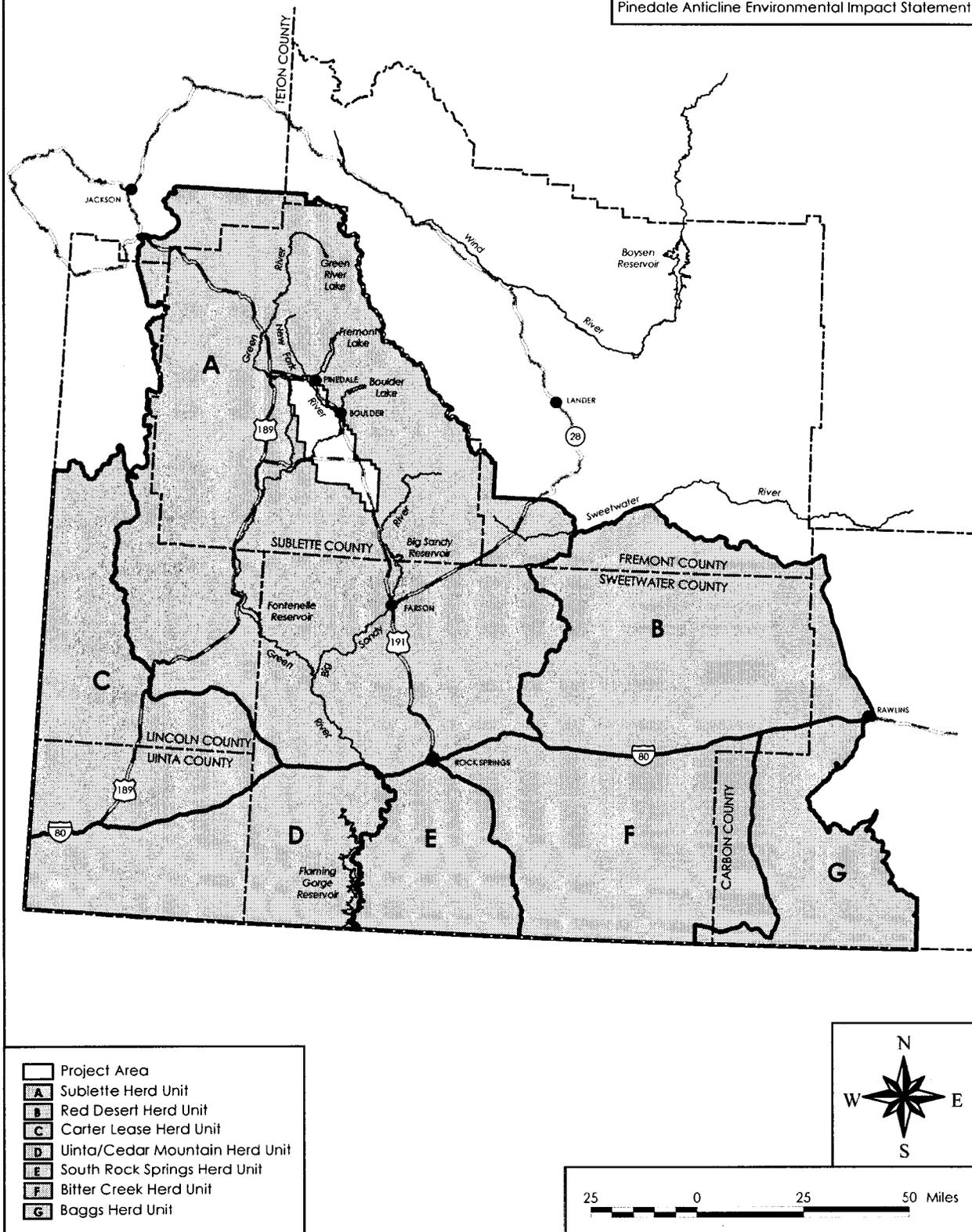


Table 5-12
Oil and Gas Developments in Southwest Wyoming Since 1984 That Coincide with Season Ranges Used by Pronghorn in Seven Antelope Herd Units

Antelope Herd Unit - Number	Oil/Gas Developments in Herd Unit with Year of NEPA Document ¹	Average Density of Active Oil/Gas Wells ² and Roads ³ in Antelope Seasonal Habitats		
		Crucial Winter Ranges	Non-Crucial Winter Ranges	Spring-Summer-Fall Ranges
Sublette - 401	Riley Ridge - 1984 Soda Unit - 1988	0.21 active wells/mi ² (1 well/4.8 mi ²)	0.13 active wells/mi ² (1 well/7.6 mi ²)	0.42 active wells/mi ² (1 well/2.4 mi ²)
	Fontenelle - 1991/1992/1997 Big Piney/LaBarge CAP - 1991 East LaBarge Infill - 1992 Bird Canyon - 1992 Burley Field - 1994 Jonah Field - 1994/1998 Essex Mountain - 1995 Stagecoach Draw - 1995 Moxa Arch Expansion - 1997	2.02 miles of road/mi ² (1 mile/0.5 mi ²)	1.82 miles of road/mi ² (1 mile/0.5 mi ²)	1.52 miles of road/mi ² (1 mile/0.7 mi ²)
Uinta-Cedar Mtn - 411	Hickey/Table Mtn - 1987 Moxa Arch Expansion - 1997	0.00 active wells/mi ²	0.09 active wells/mi ² (1 well/10.9 mi ²)	0.07 active wells/mi ² (1 well/14.3 mi ²)
		1.09 miles of road/mi ² (1 mile/0.9 mi ²)	0.65 miles of road/mi ² (1 mile/1.5 mi ²)	0.62 miles of road/mi ² (1 mile/1.6 mi ²)
South Rock Springs - 412	none	0.06 active wells/mi ² (1 well/17.9 mi ²)	0.06 active wells/mi ² (1 well/16.4 mi ²)	0.04 active wells/mi ² (1 well/23.3 mi ²)
		1.56 miles of road/mi ² (1 mile/0.6 mi ²)	1.55 miles of road/mi ² (1 mile/0.6 mi ²)	1.43 miles of road/mi ² (1 mile/0.7 mi ²)
Bitter Creek - 414	Dripping Rock/Cedar Break-1985 Mulligan Draw - 1992 Creston/Blue Gap - 1994 Continental Divide/Greater Wamsutter - 1995/IP	0.25 active wells/mi ² (1 well/4.0 mi ²)	0.29 active wells/mi ² (1 well/3.5 mi ²)	0.00 active wells/mi ²
		1.43 miles of road/mi ² (1 mile/0.7 mi ²)	0.97 miles of road/mi ² (1 mile/1.0 mi ²)	0.00 miles of road/mi ²
Carter Lease - 419	Moxa Arch Expansion - 1997	0.58 active wells/mi ² (1 well/1.7 mi ²)	0.06 active wells/mi ² (1 well/15.6 mi ²)	0.26 active wells/mi ² (1 well/3.8 mi ²)
		0.99 miles of road/mi ² (1 mile/1.0 mi ²)	0.73 miles of road/mi ² (1 mile/1.4 mi ²)	1.02 miles of road/mi ² (1 mile/1.0 mi ²)
Baggs - 438	Sierra Madre Oil and Gas Unit - 1987 Creston/Blue Gap - 1994 Continental Divide/Greater Wamsutter - 1995/IP South Baggs Area - IP	0.10 active wells/mi ² (1 well/10.4 mi ²)	0.05 active wells/mi ² (1 well/21.7 mi ²)	0.01 active wells/mi ² (1 well/90.9 mi ²)
		0.03 miles of road/mi ² (1 mile/31.3 mi ²)	0.56 miles of road/mi ² (1 mile/1.8 mi ²)	0.00 miles of road/mi ²
Red Desert - 615	Hay Reservoir Unit - 1992 Creston/Blue Gap - 1994 Bravo Unit - 1995 Continental Divide/Greater Wamsutter II - 1995/IP	0.13 active wells/mi ² (1 well/7.6 mi ²)	0.15 active wells/mi ² (1 well/6.5 mi ²)	0.06 active wells/mi ² (1 well/16.9 mi ²)
		0.93 miles of road/mi ² (1 mile/1.1 mi ²)	1.20 miles of road/mi ² (1 mile/0.8 mi ²)	1.30 miles of road/mi ² (1 mile/0.8 mi ²)

1 = Data source from BLM, 1998c: Southwest Wyoming Resource Evaluation Report and Recommendations. (IP indicates the NEPA document is in progress)

2 = BLM oil/gas well database overlaid on WGFD antelope seasonal range maps.

3 = Road database TIGER including U.S. highways, state and county roads, and BLM roads, and some two-track field roads and overlaid on WGFD mule deer seasonal range maps.

Wildlife Technical Report). Those data were used to compute fawn production rates (numbers of fawns per female 2+ years old) and maximum fawn survival between age 6 months to 18 months. Production rates of pronghorn fawns show diminished productivity in all herd units subject to increased oil and gas developments since the early 1990's. Maximum fawn survival rates, though, were mostly unchanged from before to after implementation of major projects. The data do not conclusively identify decreased fawn production as a result of oil and gas developments within affected herd units: there are other factors influencing fawn productivity as well, principally winter precipitation, but also population size (density-dependent reproduction), availability and nutritional value of forage, availability of water and competition with other herbivores. Winter precipitation, though, can play a major role in pronghorn population growth, both in terms of fawn production after winter and fawn survival through the winter.

Winter precipitation was compiled for each Antelope Herd Unit, 1977 through 1998 from data reported by NOAA cooperators at locations nearest pronghorn winter ranges. The winter of 1983-84 was considered to be an extremely severe winter with precipitation well above 30-year averages. Pronghorn fawn production and survival rates following winter 1983-84 were well below averages in all but one population. During the 1990's, there were winters after which fawn production rates were even lower than those following winter 1983-84 but total winter precipitation was markedly less than that extreme winter. Lowest fawn production rates in four herd units during the 1990's were below rates determined following winter 1983-84 but occurred in years with much lower winter precipitation than during that severe winter.

These observations raise more questions than they answer. Estimates of pronghorn populations were quite large during the late 1980's and early 1990's and WGFD managed harvest to reduce the populations by including substantial harvest of females and juveniles. Following the winter of 1983-84 there were several years of below average winter, spring and summer precipitation that undoubtedly allowed for increased survival and population growth but probably had adverse effects on vegetation succulence, abundance and nutrition. Too, oil and gas projects proliferated during the early 1990's. After winter of 1992-93, most populations suffered much lower fawn production and lower survival with relatively less winter precipitation than expected given similar effects following the severe winter of 1983-84. For whatever reason(s), it appears that habitat

functions of crucial and non-crucial winter ranges in these herd units have become diminished since the early 1980's. The situation warrants much closer investigation before cumulative effects due to oil and gas developments and other land uses on pronghorn populations can be discerned and/or predicted.

Mule Deer. The CIAA used to analyze cumulative impacts on mule deer populations (Figure 5-8) includes seven Mule Deer Herd Units (Sublette, Wyoming Range, Uinta, South Rock Springs, Baggs, Steamboat and Chain Lakes) in southwestern Wyoming. In each herd unit, locations of oil and gas wells and roads were superimposed on seasonal ranges using the same approach as discussed for pronghorn populations. Densities of active wells and roads in crucial winter ranges, non-crucial winter ranges, and spring-summer-fall ranges are presented in Table 5-13 along with a listing of oil and gas projects that either are being developed or have been developed in each herd unit since 1984.

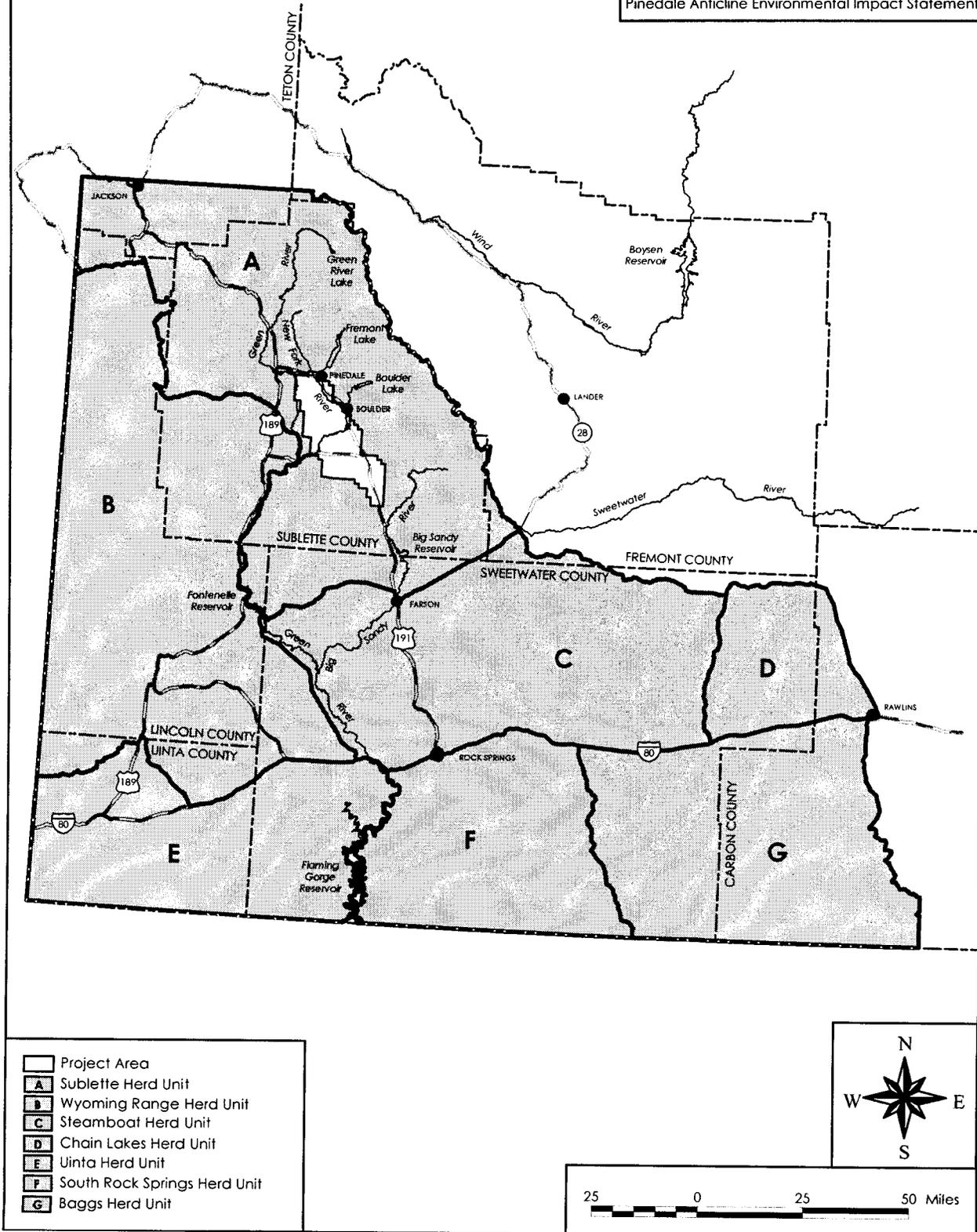
Of all mule deer populations, the Wyoming Range Herd Unit (Number 131) has been impacted most by oil and gas development and road proliferation, especially on crucial winter ranges where well densities average over one well per square mile and road densities average nearly two miles of road per square mile of crucial winter habitat. That level of industrial development occurred in the Whitney Canyon-Carter Lease fields prior to 1984. Densities of wells on crucial winter ranges of the Sublette Herd Unit rank second. Both the Sublette and Steamboat herd units have high road densities in crucial and non-crucial winter ranges (Table 5-13). Implementation of any of the alternatives presented for the PAPA would increase well and road densities in crucial and non-crucial winter ranges of the Sublette Mule Deer Herd Unit above those shown in Table 5-13.

There are 7,711 oil or gas wells that could still be drilled for NEPA-approved project areas that overlap with all seven herd units. Of these, 4,569 wells could be drilled in the Sublette Mule Deer Herd Unit. An additional 200 wells could be drilled anywhere in the RMP area within the next 10 to 15 years. There is no way to determine, however, how many of these wells might be drilled in mule deer crucial or non-crucial winter ranges in the Sublette Mule Deer Herd Unit or in other herd units in southwestern Wyoming. Similar to the analysis discussed for pronghorn populations, possible effects of major oil and gas development on mule deer population parameters were examined from post-harvest herd composition survey field data collected by WGFD in six of the seven herd units

Figure 5-8

Mule Deer Cumulative
Impact Analysis Area

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**Table 5-13
Oil and Gas Development Projects in Southwest Wyoming Since 1984 that Coincide with Seasonal Ranges Used by Mule Deer in Seven Mule Deer Herd Units**

Mule Deer Herd Unit - Number	Oil/Gas Developments in Herd Unit with Year of NEPA Document ¹	Average Density of Active Oil/Gas Wells ² and Roads ³ In Mule Deer Seasonal Habitats		
		Crucial Winter Ranges	Non-Crucial Winter Ranges	Spring-Summer-Fall Ranges
Sublette - 104	Soda Unit - 1988 Jonah Field - 1994/1998 Stagecoach Draw - 1995 Fontenelle - 1997	0.36 active wells/mi ² (1 well/2.8 mi ²) 1.72 miles of road/mi ² (1 mile/0.6 mi ²)	0.03 active wells/mi ² (1 well/34.9 mi ²) 1.87 miles of road/mi ² (1 mile/0.5 mi ²)	0.003 active wells/mi ² (1 well/333.3 mi ²) 0.80 miles of road/mi ² (1 mile/1.3 mi ²)
Wyoming Range - 131	Riley Ridge - 1984 Fontenelle - 1991/1992/1997 Big Piney/LaBarge CAP - 1991 East LaBarge Infill - 1992 Bird Canyon - 1992 Burley Field - 1994 Moxa Arch Expansion - 1997	1.38 active wells/mi ² (1 well/0.7 mi ²) 1.84 miles of road/mi ² (1 mile/0.5 mi ²)	0.30 active wells/mi ² (1 well/3.3 mi ²) 1.67 miles of road/mi ² (1 mile/0.6 mi ²)	0.04 active wells/mi ² (1 well/24.4 mi ²) 0.93 miles of road/mi ² (1 mile/0.9 mi ²)
Uinta - 423	Hickey/Table Mtn - 1987 Moxa Arch Expansion - 1997	0.03 active wells/mi ² (1 well/29.4 mi ²) 0.57 miles of road/mi ² (1 mile/1.7 mi ²)	0.03 active wells/mi ² (1 well/30.3 mi ²) 0.29 miles of road/mi ² (1 mile/3.4 mi ²)	0.14 active wells/mi ² (1 well/7.2 mi ²) 0.00 miles of road/mi ²
South Rock Springs - 424	none	0.01 active wells/mi ² (1 well/111.1 mi ²) 0.00 miles of road/mi ²	0.10 active wells/mi ² (1 well/9.6 mi ²) 1.36 miles of road/mi ² (1 mile/0.7 mi ²)	0.06 active wells/mi ² (1 well/17.2 mi ²) 1.47 miles of road/mi ² (1 mile/0.7 mi ²)
Baggs - 427	Dripping Rock/Cedar Break- 1985 Sierra Madre - 1997 Mulligan Draw - 1992 Creston/Blue Gap - 1994 Continental Divide/Greater Wamsutter - 1992/1995/IP South Baggs Area - IP	0.21 active wells/mi ² (1 well/4.9 mi ²) 0.33 miles of road/mi ² (1 mile/3.0 mi ²)	0.32 active wells/mi ² (1 well/3.1 mi ²) 0.68 miles of road/mi ² (1 mile/1.5 mi ²)	0.01 active wells/mi ² (1 well/142.9 mi ²) 0.93 miles of road/mi ² (1 mile/142.9 mi ²)
Steamboat - 430	Hay Reservoir Unit - 1992 Creston/Blue Gap - 1994 Stagecoach Draw - 1995 Essex Mountain - 1995 Bravo Unit - 1995 Continental Divide/Greater Wamsutter II - 1992/1995/IP	0.14 active wells/mi ² (1 well/7.2 mi ²) 1.75 miles of road/mi ² (1 mile/0.6 mi ²)	0.08 active wells/mi ² (1 well/12.1 mi ²) 1.71 miles of road/mi ² (1 mile/0.6 mi ²)	0.22 active wells/mi ² (1 well/4.6 mi ²) 1.44 miles of road/mi ² (1 mile/0.7 mi ²)
Chain Lakes - 650	Continental Divide/Greater Wamsutter II - 1992/1995/IP	0.00 active wells/mi ² 0.00 miles of road/mi ²	0.03 active wells/mi ² (1 well/37.3 mi ²) 1.03 miles of road/mi ² (1 mile/1.0 mi ²)	0.000 active wells/mi ² 0.00 miles of road/mi ²

1 = Data source from BLM, 1998c: Southwest Wyoming Resource Evaluation Report and Recommendations. (IP indicates the NEPA document is in progress)

2 = BLM oil/gas well database overlaid on WGFD mule deer seasonal range maps.

3 = Road database from TIGER including US highways, State and County roads, and BLM roads, and some two-track field roads and overlaid on WGFD mule deer seasonal range maps.

since the late 1970's to mid-1980's (see Wildlife Technical Report). Insufficient herd composition data has been collected for the Chain Lakes Herd Unit for it to be included in the analysis. These data were used to compute fawn production rates and maximum fawn survival rates each year. Mule deer fawn production rates in four herd units show slightly diminished productivity in three of them following increased oil and gas developments. Maximum fawn survival rates were mostly unchanged from before to after implementation of major projects.

As discussed in Chapter 4, winter precipitation is a major influence on mule deer winter survival, especially for fawns. Winter precipitation was compiled for each mule deer herd unit as total inches of water, November through March for each winter 1977 through 1998. Data reported by NOAA cooperators at locations nearest mule deer winter ranges were averaged for each month if there was more than one station reporting. The winter of 1983-84 was considered to be an extremely severe winter with precipitation well above 1961-1990 averages.

Mule deer fawn production rates following the winter of 1983-84 in the four populations for which data were available (Sublette, Wyoming Range, Baggs, Steamboat) were near or somewhat below averages for the populations. Fawn survival rates through that winter were far below averages. During the 1990's, there were winters after which fawn production rates were even lower than those determined following the winter of 1983-84, but total winter precipitation was markedly less than the 1983-84 extreme winter. Lowest fawn production rates and survival rates in four herd units analyzed during the 1990's were below rates determined following the winter of 1983-84 but occurred in years with much lower winter precipitation than that year.

Analysis conducted on the Sublette and Wyoming Range herd units has shown that as total winter precipitation increased, maximum fawn survival decreased. An especially interesting relationship was found in an analysis conducted on the Sublette Herd Unit data where the rate of decrease for fawn survival with increasing precipitation was significantly greater between 1994 and 1997 than before 1994. That is, fawn survival rates as a function of winter precipitation have been less since 1994 than expected based on survival rates and precipitation observed before 1994. No similar relationships were found in any other mule deer population.

Estimates of mule deer populations were quite large during the late 1980's and early 1990's and

efforts to reduce the populations were made through substantial harvest of females and juveniles. Winters from the mid-1980's through the early 1990's were relatively mild with low precipitation that undoubtedly allowed for increased fawn survival and population growth. Oil and gas projects were on the increase during the early 1990's. During the winter of 1992-93 the four populations analyzed (Sublette, Wyoming Range, Baggs, Steamboat) suffered lower fawn production and lower fawn survival with relatively lower winter precipitation than would have been expected given similar effects following the severe winter of 1983-84. Those parameters could also have been influenced by population size (density-dependent reproduction), availability and nutritional value of forage, availability of water, very low temperatures and competition with other herbivores. For whatever reason(s), habitat functions of crucial and non-crucial winter ranges in these mule deer herd units do not appear to be as effective as they were in the early 1980's.

Moose. The CIAA used to analyze cumulative impacts on moose (Figure 5-6) includes wetlands associated with the Green River and tributaries above Fontenelle Reservoir and the Big Sandy River and tributaries above Big Sandy Reservoir. Spatial databases for well locations and roads were superimposed on wetlands that are utilized by moose, principally wet meadows (palustrine emergent wetlands) and riparian scrub shrub (palustrine scrub shrub and palustrine forested wetlands) cover types. These wetlands coincide with crucial winter-yearlong habitats used by moose in the Sublette Moose Herd Unit.

Within the CIAA there are 167.7 square miles of the three wetland types. Roads have been constructed in all three wetland types: 50.6 miles of road within palustrine emergent, 0.22 miles within palustrine forested and 17.5 miles within palustrine scrub shrub wetlands. Some of the roads tallied within wetlands are paved U.S. Highways and state or county roads. There are eight gas well sites in palustrine emergent and five wells in palustrine scrub shrub wetlands.

According to WGFD population estimates, moose in the Sublette Herd Unit increased from 1993 through 1996 but winter conditions during winter 1996-97 depressed calf production and increased mortality (McWhirter, 1998c). Moose winter ranges in this herd unit within the Pinedale Resource Area occur mostly on private land. While most private landowners tolerate moose, animals do damage hay and other crops. In those areas, special hunt seasons have

been implemented to remove nuisance animals. Indeed, probably the greatest impact to moose arise from conflicts between agricultural and residential developments in riparian areas.

Implementation of any of the project alternatives for the PAPA would avoid locating well pads within 500 feet of wetlands and perennial streams on Federal lands and minerals. Wells could be located within that zone on lands that have either state or private surface and mineral ownership. Consequently, additional moose habitats in the PAPA could be impacted by well pads and road construction. Only the RP Alternative on All Lands and Minerals would exclude well pads from within 500 feet of wetlands in the PAPA. Within the Moose CIAA, 3,491 oil or gas wells have been approved in the NEPA process and could still be drilled. A projected 200 wells could be drilled anywhere in the Pinedale RMP Area during the next 10 to 15 years. The locations of these are unknown but if they were placed in riparian zones on non-Federal lands and minerals ownership, additional moose habitat would be impacted.

Sage Grouse. The CIAA used to analyze cumulative impacts on sage grouse (Figure 5-9) includes two Upland and Small Game Management Areas (USGMAs) that include the PAPA - Area 3 (Sublette) and Area 7 (Eden). Known sage grouse leks in each USGMA were plotted from locations provided by WGFD with evaluations as active, inactive or unknown activity status during the past five years. There were 113 leks in Area 3 and 135 leks in Area 7. Concentric circles with radii of 0.25 mile, 0.5 mile, 2 miles and 3 miles were generated around each lek location. Locations of oil and gas wells and roads were superimposed on leks and their concentric circles. Numbers of active wells and miles of road within radii of each concentric circle were computed for all leks and are summarized in Table 5-14 along with lists of the oil and gas projects that have been or are being developed in USGMAs since 1984. Clearly, many more wells in USGMA 3 are closer to leks (within 0.25-0.50 mile) than in USGMA 7.

It appears that, in USGMA 3, more than three times as many leks with at least one oil or gas well within a 0.50-mile radius are inactive than are active. Of leks with at least one well within a 0.25-mile radius, four times as many are inactive than active. More leks in both USGMAs are active than inactive with nearest wells at distances between two and three miles away. With any of the alternatives for proposed development on the PAPA, numbers of wells and miles of road would increase in both USGMAs within

distances between 0.25 mile and three miles of leks but not within 0.25 miles since BLM would avoid placement of well pads, roads and above-ground structures within 0.25 miles of active sage grouse leks. There are 3,080 oil or gas wells that could still be drilled in NEPA-permitted project areas that overlap with both USGMAs. Two hundred additional wells could be drilled anywhere in the RMP area within the next 10 to 15 years but locations of any wells relative to sage grouse leks are not known.

The data from USGMA 3 indicates that sage grouse leks with a well(s) within distances of 0.25 to 2 miles are more likely to be inactive than active but do not demonstrate a cause-and-effect relationship between well proximity and lek activity. Additional information, including when wells were constructed in relation to lek activity history and subsequent activity status, would be necessary before drawing such a conclusion. Noise associated with nearby oil and gas developments and operations may adversely affect sage grouse reproduction by interfering with auditory stimuli during courtship (see Chapter 4) but additional research is necessary before such impact is known with certainty.

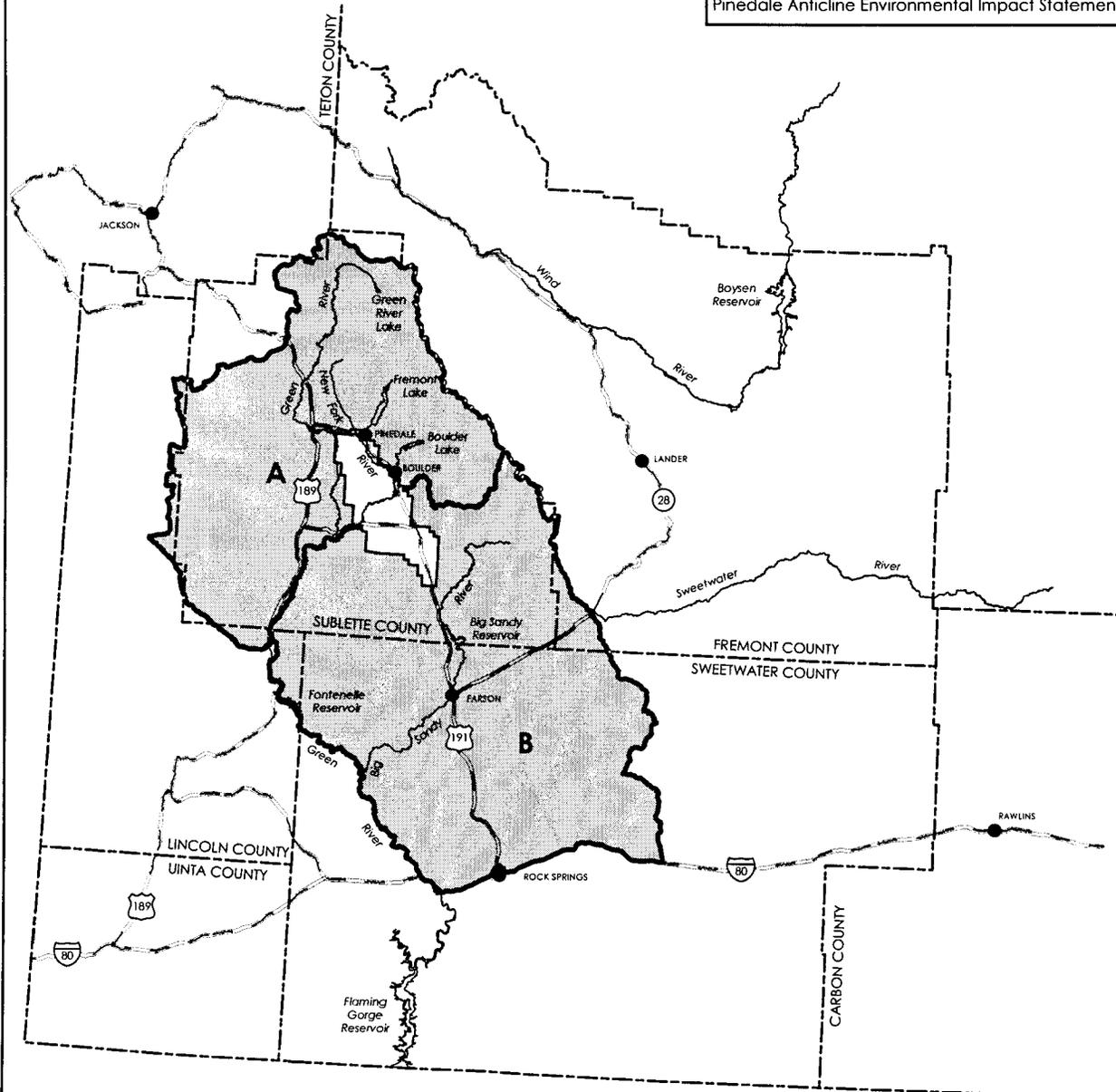
Raptors. The CIAA used to analyze cumulative impacts on nesting raptors includes two miles beyond the perimeter of the PAPA and the Jonah II Field adjacent to the PAPA. Existing numbers of wells and miles of roads within applied buffer zones surrounding known nest sites were evaluated using the same spatial databases as used for analyses of these impact sources on big game and sage grouse.

Within the CIAA there are three well pads within 0.5 mile but beyond 825 feet of any buteo hawk nest (except ferruginous hawks) or golden eagle nest; no wells are within 825 feet of these species' nests. However, there are 10.7 miles of existing roads within the 825-foot buffer surrounding nests of buteos and/or golden eagles. There are 4.6 miles of road and one well site within 1,000 feet of ferruginous hawk nests in the CIAA. The degree to which roads and wells within these distance have affected raptor nesting success in the CIAA is unknown because nesting histories for each nest are not documented nor are the periods of road construction known. Although implementing any alternative for development in the PAPA would not add wells or roads within 825 feet of any nest, only the RP alternatives would exclude additional road and well pad construction within a 1,000-foot radius of ferruginous hawk nests. Nevertheless, 321 additional wells in the Jonah II Field and 200 wells in the Pinedale Resource Area could be drilled in the foreseeable future.

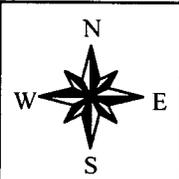
Figure 5-9

Sage Grouse Cumulative
Impact Analysis Area

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- Project Area
- Sublette Upland and Small Game Management Area 3
- Eden Upland and Small Game Management Area 7



**Table 5-14
Oil and Gas Developments in Southwest Wyoming Since 1984 That Coincide with Sage Grouse Lek Locations in Two Upland and Small Game Management Areas**

Upland and Small Game Management Area - Number	Oil/Gas Developments in USGMA with Year of NEPA Document ¹	Total Number of Oil/Gas Wells ² and Miles of Road ³ Within Distances of Sage Grouse Leaks			
		Within 0.25 miles	Within 0.50 miles	Within 2.0 miles	Within 3.0 miles
Sublette - USGMA 3	Riley Ridge - 1984 Soda Unit - 1988 Fontenelle - 1991/1992/1997 Big Piney/LaBarge CAP - 1991 East LaBarge Infill - 1992 Bird Canyon - 1992 Burley Field - 1994	21 wells 53.9 miles of road	75 wells 168.8 miles of road	916 wells 1,336.9 miles of road	1,280 wells 1,988.5 miles of road
Eden - USGMA 7	Jonah Field - 1994/1998 Essex Mountain - 1995 Stagecoach Draw - 1995 Fontenelle - 1997	2 wells 55.6 miles of road	6 wells 190.2 miles of road	112 wells 1,872.3 miles of road	212 wells 3,067.8 miles of road

1 = Data source from BLM, 1998c: Southwest Wyoming Resource Evaluation Report and Recommendations.

2 = BLM oil/gas well database overlaid on sage grouse lek location maps.

3 = Road database from US-Department of Commerce, TIGER coverage, including US highways, state and county roads, and BLM roads, and some two-track field roads and overlaid on sage grouse lek location maps.

Fisheries. The CIAA used to analyze cumulative impacts on fisheries (Figure 5-5) includes the Green River and tributaries above Fontenelle Reservoir and the Big Sandy River and tributaries above Big Sandy Reservoir. Spatial databases for well locations and roads were superimposed on drainages classified as Stream Class 2 (very good trout waters with fisheries of statewide importance) and Stream Class 3 (important trout waters with fisheries of regional importance). Of those fisheries in the CIAA, there are five wells and 20.2 miles of road within 100 feet and 23 wells and 265.9 miles of road within 500 feet of streambanks. Some of the roads included within those distances are paved U.S. highways and state or county roads.

Implementation of any of the project alternatives for the PAPA would avoid locating well pads within 500 feet of wetlands and perennial streams on Federal lands and minerals. However, wells could be located within that zone on non-Federal lands and minerals. Consequently, Class 2 and Class 3 fisheries within and downstream of the PAPA could be impacted from increased sedimentation and discharge by additional well pads within 500 feet of their streambanks and associated wetlands. Only the RP Alternative on All Lands and Minerals would exclude well pads from within 500 feet of wetlands, riparian areas and perennial streams on all lands in the PAPA. Water withdrawals throughout the CIAA are unknown, but any water withdrawn from the Green River and its tributaries would be a cumulative impact to endangered fish species in the Colorado River downstream from Fontenelle Dam.